Acoustic Telemetry Modems

User's Manual

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Preface

Congratulations on your purchase of a Benthos Series Acoustic Telemetry Modem! The ATM-880 and ATM-890 Series Acoustic Telemetry Modems, which employ the latest in digital signal processing technologies, are the most advanced underwater modems available. They offer a low cost yet reliable and effective alternative to many underwater communications systems.

This manual provides information on setting up, testing, and operating the ATM-880 and ATM-890 Series Acoustic Telemetry Modems. It is divided into the following ten sections:

Section 1 - Overview reviews the available modem configurations and describes the two advanced modulation techniques used.

Section 2 - Specifications lists the specifications for the modems, the modem transducers, and the modem battery packs.

Section 3 - Deployment Considerations reviews important installation considerations to ensure the best possible modem performance.

Section 4 - Setup and Test provides instructions for unpacking, setting up, and testing the modems, and includes some simple procedures to verify that commands and data are correctly transmitted and received.

Section 5 - TelesonarPC provides installation and operating instructions for TelesonarPC, a graphical users interface (GUI) that provides a user friendly means of configuring and operating the modems in a Windows environment.

Section 6 - Modem Operating Modes and Commands describes the modem operating modes and provides detailed descriptions of the modem commands and how to use them.

Section 7 - Modem Operating Parameters (S Registers) provides detailed descriptions of the modem operating parameters, or S Registers, and how to set them.

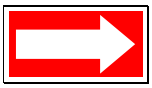
Section 8 - Maintenance and Troubleshooting provides instructions for cleaning and inspecting the modems, changing the battery packs, and troubleshooting operational problems that might occur during setup.

Section 9 - Drawings includes outline drawings of the modems to assist in their installation and setup.

Section 10 - Modem Components and Accessories Includes lists of the available ATM-880 and ATM-890 Series Acoustic Telemetry Modem components, along with cables and OEM kits.

Notes and Warnings

Where applicable, special notes and warnings are presented as follows:



NOTE A referral to another part of this manual or to another reference; a recommendation to check that certain criteria are met before proceeding further in a step or sequence; or general information applicable to the setup and operation of the ATM-880 Series Acoustic Telemetry Modems.

WARNING A reminder that dangerous or damaging consequences could result if certain recommended procedures are not followed.

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We welcome your comments and suggestions for improving our products and documentation as well as developing better ways of serving you with acoustic technology. Therefore, please contact Customer Service should you have any comments or suggestions about this manual or the ATM-880 and ATM-890 Series Acoustic Telemetry Modems, or if you require service or support.

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Contents

Notices ii
Proprietary Information ii
Warranty ii
Liability iii
Title iv
Changes iv
Preface v
Notes and Warnings vi
Customer Service vi
Contents vii
List of Figures xv
List of Tables xvii

1 Overview 1-1

Modem and Transducer Configurations 1-2
Surface Modems 1-2
ATM-891 Deck Box 1-3
Model ATM-880 Module 1-3
Subsea Modems 1-4
ATM-885 and ATM-885R Acoustic Telemetry Modems 1-4
ATM-887 and ATM-887R Acoustic Telemetry Modems 1-4
ATM-888 Acoustic Telemetry Modem 1-5
SMART Releases 1-6
SR-100 SMART Release 1-6
Modem Board Sets 1-7
ATM-885PCB Modem Board Set 1-7
ATM-885RPCB Modem Board Set 1-8
Remote Transducers 1-8
AT-408 Omnidirectional Transducer 1-9
AT-421 Directional Transducer 1-9
Acoustic Baffles 1-10
Typical Applications 1-11
Remote Data Acquisition 1-11
AUV Command and Control 1-13
Modem Performance Factors 1-14

Barriers to Underwater Communications 1-14
Sound Speed in Seawater 1-14
Signal Fading 1-15
Multipath Interference and Reflections 1-15
High Performance Modulation Techniques 1-16
Methods for Increasing Reliability 1-16
Convolutional Coding 1-17
Multipath Guard Period 1-17
Data Redundancy 1-17

2 Specifications 2-1

General 2-1
ATM-891 Deck Box 2-2
Physical Characteristics 2-2
Power Requirements 2-2
Input/Output 2-2
Transducers 2-3
ATM-885 Subsea Modem 2-3
Physical Characteristics 2-3
Power Requirements 2-3
Input/Output 2-4
Transducers 2-4
ATM-885R Subsea Modem 2-4
Physical Characteristics 2-4
Power Requirements 2-5
Input/Output 2-5
Transducers 2-5
ATM-887 Subsea Modem 2-5
Physical Characteristics 2-6
Power Requirements 2-6
Input/Output 2-6
Transducers 2-6
ATM-887R Subsea Modem 2-7
Physical Characteristics 2-7
Power Requirements 2-7
Input/Output 2-7
Transducers 2-8
ATM-888 Subsea Modem 2-8
Physical Characteristics 2-8
Power Requirements 2-8
Input/Output 2-9
Transducers 2-9

ATM-885PCB Modem Board Set 2-9
Physical Characteristics 2-9
Power Requirements 2-9
Input/Output 2-10
Transducers 2-10
ATM-885RPCB Modem Board Set 2-10
Physical Characteristics 2-10
Power Requirements 2-11
Input/Output 2-11
Transducers 2-11
AT-408 Omnidirectional Transducer 2-11
AT-421 Directional Transducer 2-12
Modem Battery Packs 2-13
Modem Battery Pack for ATM-885/885R Acoustic Telemetry Modems 2-13
Modem Battery Pack for ATM-887/887R Acoustic Telemetry Modems 2-13

3 Deployment Considerations 3-1

Remote Transducer Selection 3-1
Modem Battery Pack 3-2
Battery Pack Currents 3-2
Processing Overhead 3-2
Modem Battery Pack Capacity Calculations 3-3
Verifying the Modem Battery Pack Capacity for a Short Deployment 3-3
An Example Deployment Calculation 3-4
Modem Operating Depth 3-6
Modem Communications Range 3-6
Multipath and Noise 3-6
Transducer Orientation 3-7
Use of an Acoustic Baffle 3-7
Height Above the Bottom and Distance Below the Surface 3-7
Other Acoustic Equipment 3-7
Typical Deployment Configurations 3-8
Dunking Transducer Deployment 3-8
Subsea Modem Deployment 3-9
Mounting Instruments to the ATM-888 Subsea Modem 3-9

4 Setup and Test 4-1

Unpacking and Inspection 4-1
Typical Setup Configurations 4-2
Modem Connections 4-3
ATM-891 Deck Box Front Panel Connectors 4-4
Subsea Modem Connectors 4-5
Modem Operator Functions 4-5
ATM-891 Deck Box Operator Functions 4-5
Subsea Modem Operator Functions 4-6
Setting Up the Modems 4-7
Setting up the ATM-891 Deck Box 4-7
Setting up the Subsea Modems 4-9
Setting up the Modem Board Sets 4-11
Setting up the ATM-880 Module 4-15
Setting up the Host Processor 4-15
Checking the Modems and Host Processors 4-16
Verifying Operation of the ATM-891 Deck Box 4-16
Verifying a Modem's Operating Parameters 4-16
Setting a Modem's Operating Parameters 4-18
Checking the Acoustic Link between Two Modems in Air 4-19

5 TelesonarPC 5-1

Installing and Starting TelesonarPC 5-1
Installing TelesonarPC 5-1
Starting TelesonarPC 5-2
Checking the TelesonarPC Version Number 5-4
Exiting TelesonarPC 5-4
Uninstalling TelesonarPC 5-5
The Main Window 5-5
Menu Bar 5-6
Status Bar 5-7
Status Displays 5-8
Data Displays 5-10
Displaying Warning Messages 5-10
Updating the Status Displays for the Remote Modem 5-10

Battery Pack Capacity Usage and Deployment Length Calculations 5-11
Transmitting a Relatively Large Data File—Short Deployment 5-11
Transmitting Relatively Small Data Files Periodically—Long Deployment 5-13
Configuring the Local and Remote Modems 5-15
Selecting and Configuring the Local Modem's Serial Communications Port 5-15
Selecting the Range Options 5-17
Selecting Units of Relative Speed 5-18
Configuring the Local Modem's Operating Parameters (S Registers) 5-18
Advanced Local Modem Settings 5-21
Configuring the Remote Modem's Operating Parameters (S Registers)—before Deployment 5-22
Advanced Remote Modem Settings 5-25
Configuring the Remote Modem's Operating Parameters (S Registers)—after Deployment 5-25
Configuring the Remote Modem's Serial Communications Port—after Deployment 5-28
Configuring the Local and Remote Modems Using Auto Configuration 5-29
Operating the Modems after Deployment 5-31
Going Online with a Different Remote Modem 5-31
Checking the Acoustic Link between the Local and Remote Modems 5-31
Checking the Range between the Local and the Remote Modem's Transducers 5-32
Auto Ranging between the Local and Remote Modem's Transducers 5-33
Changing the Transmit Power Levels of the Local and Remote Modems 5-34
Changing the Acoustic Transmit Baud Rate of the Local and Remote Modems 5-35
Enabling and Disabling the Data Logger of the Remote Modem 5-35
Checking the Data Logger Memory of the Remote Modem 5-35
Downloading the Contents of the Remote Modem's Data Logger Memory to a File 5-36
Clearing the Contents of the Remote Modem's Data Logger Memory 5-37

Capturing Received Data from the Remote Modem 5-38
Uploading Data from a File to the Remote Modem 5-39
Sending a Break to the Remote Modem 5-40
Operating a SMART Release 5-41
Checking the Status of a SMART Release 5-41
Activating the Release Mechanism of a SMART Release 5-42
Modem Diagnostics 5-44
Checking the Battery Pack Voltages 5-44
Viewing the Background Noise Level of the Local Modem 5-45
Performing the Ping Test 5-46
Checking the Local Modem's Firmware Version Number 5-47

6 Modem Operating Modes and Commands 6-1

Operating Modes 6-1
Online Mode 6-2
Device Enable 6-3
Transmit Data Buffers 6-3
Data Format 6-5
Online Break 6-5
Error Checking 6-5
Command Mode 6-5
Lowpower State 6-7
Acoustic Command Execution 6-8
Datalogger Mode 6-8
Entering Commands 6-10
Online Interrupt . . . . . +++ 6-15
Attention . . . . . AT 6-17
Dial . . . . . ATDn 6-19
Factory Reset . . . . . AT&F 6-21
Hang Up . . . . . ATH 6-23
Online . . . . . ATO 6-25
Acoustic Link Test . . . . . ATXn 6-27
Multiple Baud Rate Test . . . . . ATYn 6-29
Remote Power . . . . . AT$Pn,m 6-31
Remote Baud Rate . . . . . AT$An,m 6-33

Read Register . . . . . ATSn? 6-35
Read Remote Registers . . . . . AT$Sn 6-37
Set Register. . . . . ATSn=n 6-39
Write. . . . . AT&W 6-41
Lowpower State . . . . . ATL 6-43
Range. . . . . ATRn 6-45
Remote Doppler Tracking . . . . . AT$Dn,m 6-47
Local Battery Voltage. . . . . ATV 6-49
Remote Battery Voltage . . . . . AT$Vn 6-51
Remote Data Logger Enable . . . . . AT$BEn 6-53
Remote Data Logger Disable. . . . . AT$BDn 6-55
Read Remote Data Logger. . . . . AT$BTn 6-57
Output Data Logger Block . . . . . AT$BBn,m 6-59
Clear Remote Data Logger. . . . . AT$BCn 6-61
Remote Bytes Stored . . . . . AT$BNn 6-63
Clear Local Data Logger . . . . . ATBC 6-65
Local Bytes Stored . . . . . ATBN 6-67
Output Local Data Logger . . . . . ATBT 6-69
Output Local Page . . . . . ATBPn 6-71
AGC Diagnostic . . . . . ATTNn 6-73
Release Status . . . . . AT$Tn 6-75
Release . . . . . AT$Rn,m 6-77

7 Modem Operating Parameters (S Registers) 7-1

Software Version Number S0 7-3
Doppler Tracking S1 7-5
Packet Retry S2 7-7
Serial Baud Rate S3 7-9
Acoustic Baud Rate S4 7-11
Reserved S5 7-13
Transmit Power Level. S6 7-15
Acoustic Response Timeout S7 7-17
Forwarding Delay S8 7-19
Coprocessor Board S9 7-21
Idle Time S10 7-23
RS-232 Driver/Flow Control S11 7-25
ATX Test Message Length S12 7-27
Verbose Level S13 7-29
Remote Address S14 7-31

Operating Mode S15 7-33
Error Display S16 7-35
Lowpower Wakeup S17 7-37
Modem Address. S18 7-39
Reserved S19 7-41
Reserved S20 7-43

8 Maintenance and Troubleshooting 8-1

General Cleaning and Inspection 8-1
Changing the Modem Battery Packs 8-2
Checking the Modem Battery Pack 8-3
Changing the ATM-885 or ATM-885R Modem Battery Pack 8-3
Changing the ATM-887 or ATM-887R Modem Battery Pack 8-5
Troubleshooting 8-7

9 Drawings 9-1

Surface Modems 9-1
Subsea Modems 9-1
Modem Board Sets 9-1
Remote Transducers 9-1
Wiring Diagrams 9-1

10 Modem Components and Accessories 10-1

List of Figures

Figure 1-1 The ATM-891 Deck Box 1-3
Figure 1-2 ATM-885 and ATM-885R Acoustic Telemetry Modems . . 1-5
Figure 1-3 ATM-887 and ATM-887R Acoustic Telemetry Modems . . 1-6
Figure 1-4 The SR-100 SMART Release 1-7
Figure 1-5 ATM-885PCB and ATM-885RPCB Modem Board Sets . . . 1-8
Figure 1-6 AT-408 Omnidirectional Transducer and Beam Pattern 1-9
Figure 1-7 AT-421 Directional Transducer and Beam Pattern 1-10
Figure 1-8 Data Acquisition and RF Link to Remote Station 1-11
Figure 1-9 Periodic Acquisition of Stored Data 1-12
Figure 1-10 Command and Control of an AUV 1-13
Figure 4-1 Setup with ATM-891 Deck Box as the Local Modem 4-2
Figure 4-2 Setup with ATM-885 as Local and Remote Modems 4-3
Figure 4-3 ATM-891 Deck Box Front Panel 4-4
Figure 4-4 Subsea Modem On/Off Switches 4-6
Figure 4-5 ATM-891 SERIAL I/O Connector 4-7
Figure 4-6 Subsea Modem POWER/SERIAL Connector 4-9
Figure 4-7 ATM-885PCB and ATM-885RPCB DSP Board Serial Connector J4 4-11
Figure 4-8 ATM-885PCB Transducer Cable Wiring Diagram 4-14
Figure 5-1 The Remote Modem Window 5-4
Figure 5-2 The Main Window 5-6
Figure 5-3 The Opened Datalogger Menu 5-7
Figure 5-4 The Battery Capacity Calculation Dialog Box—Set up for Calculating Battery Pack Usage when Transmitting One Large File 5-12
Figure 5-5 The Battery Capacity Calculation Dialog Box—Set up for Calculating Battery Pack Usage when Transmitting Data Periodically 5-14

Figure 5-6 The PC Configuration Dialog Box 5-16
Figure 5-7 The Range Options Dialog Box 5-17
Figure 5-8 The Relative Speed Units Dialog Box 5-18
Figure 5-9 The Local Modem Configuration Dialog Box 5-19
Figure 5-10 The Advanced Modem Settings Dialog Box 5-21
Figure 5-11 The Predeployment Configuration Dialog Box 5-22
Figure 5-12 The Remote Modem Configuration Dialog Box 5-26
Figure 5-13 The Serial Port Configuration Dialog Box 5-28
Figure 5-14 The DataLogger File Dialog Box 5-37
Figure 5-15 The Capture File Dialog Box 5-38
Figure 5-16 The Open File to Upload Dialog Box 5-39
Figure 5-17 The Noise Test Window 5-45
Figure 5-18 The Ping Test Dialog Box 5-46
Figure 6-1 Conditions for Recognizing an Online Interrupt Command 6-16
Figure 6-2 Read Register Command and Resulting Display 6-36
Figure 6-3 Read Remote Registers Command and Resulting Display 6-38

List of Tables

Table 4-1 ATM-891 SERIAL I/O Connector Pinouts 4-7

Table 4-2 ATM-891 SERIAL I/O Connector to DB-9 Pin-to-Pin Connections 4-8

Table 4-3 Subsea Modem POWER/SERIAL Connector Pinouts 4-9

Table 4-4 Subsea Modem POWER/SERIAL Connector to DB-9 Pin-to-Pin Connections 4-10

Table 4-5 ATM-885PCB and ATM-885RPCB DSP Board Serial Connector J4 Pinouts 4-11

Table 4-6 ATM-885PCB and ATM-885RPCB Power Supply/Filter Board Power Connector J3 Pinouts 4-12

Table 4-7 ATM-885PCB and ATM-885RPCB DSP Board Serial Connector J4 to DB-9 Pin-to-Pin Connections 4-13

Table 4-8 ATM-885PCB Transducer Cable Wiring 4-13

Table 4-9 ATM-885RPCB Bulkhead Connector Wiring 4-14

Table 6-1 ATM-880 and ATM-890 Series Acoustic Telemetry Modem Command Set 6-12

Table 7-1 ATM-880 and ATM-890 Series Acoustic Telemetry Modem S Registers 7-2

Table 8-1 Modem Battery Pack Capacity vs. Voltage 8-3

Table 10-1 Acoustic Telemetry Modems—Surface 10-1

Table 10-2 Acoustic Telemetry Modems—Subsea (2000 m) 10-1

Table 10-3 Acoustic Telemetry Modems—Subsea (6000 m) 10-1

Table 10-4 Remote Transducers 10-2

Table 10-5 OEM Kits 10-2

Table 10-6 Cables 10-2

1 Overview

The Benthos acoustic telemetry modems include the Benthos ATM-880 and ATM-890 Series Acoustic Telemetry Modems and the Smart Modem Acoustic Release Technology (SMART) Releases, along with remote transducers, circuit board sets, software, and other products in the Benthos "Telesonar" product line. The Benthos ATM-880 and ATM-890 Series Acoustic Telemetry Modems, and the SMART Releases, provide reliable wireless digital communications between deployed underwater instrument packages and surface or subsea platforms. The SMART Release is included in the ATM-880 Series, which can transmit data at baud rates as high as 15,360 bits/sec and receive data at baud rates as high as 2400 bits/sec. The ATM-890 Series can both transmit and receive at baud rates as high as 15,360 bits/sec.

NOTE "Telesonar" is derived from the words telemetry and sonar, where telemetry is data transmission, and the word sonar, a general term for the applications of underwater sound, was derived many years ago from the acronym for *so*und *na*vigation and *r*anging. Benthos manufactures and markets the ATM-880 and ATM-890 Series Acoustic Telemetry Modems worldwide under the Telesonar product line name. The Telesonar product line also includes TelesonarPC, a Windows based software program that provides a user friendly means of configuring and operating the modems.

Applications for the ATM-880 and ATM-890 Series Acoustic Telemetry Modems include remote monitoring of oceanographic sensors, control of wellhead and pipeline valves, and control of autonomous underwater vehicles (AUVs). The ATM-880 and ATM-890 Series Acoustic Telemetry Modems are the most advanced, the most multipath and noise tolerant, and the most cost efficient ever available. They are designed to meet both the high data rate requirements of commercial users, and the higher reliability, lower data rate requirements of the military. Hence the modems employ two modulation techniques: phase shift keying (PSK), which provides the highest baud rate, and multiple frequency shift keying (MFSK), which provides good reliability in a multipath environment or when the modems are required to operate in a low signal-to-noise (SNR) environment.

This section provides an overview of the ATM-880 and ATM-890 Series Acoustic Telemetry Modems, reviews a few of their many applications, and describes the high performance modulation techniques that are used.

NOTE The ATM-880 and ATM-890 Series Acoustic Telemetry Modems are not compatible with the older ATM-870 Series.

Modem and Transducer Configurations

The ATM-880 and ATM-890 Series Acoustic Telemetry Modems are organized into four main configuration groups: one group comprises the surface modems; another, the subsea modems; a third, the SMART Releases; and a fourth, the remote transducers, which are used by both the surface and subsea modems.

The surface modems consist of two modem configurations: a deck box and a modem module. The subsea modems include modems with either built-in transducers or provisions for the use of any of the remote transducers. The SMART Releases include modem electronics, a built-in transducer and a release mechanism. The remote transducers include two different types, each with unique beam patterns and available frequencies, and each with a built-in preamplifier and transmitter. In addition to the four main groups, two circuit board configurations are available for use in OEM applications. One configuration comprises a complete modem board set and a transducer. The other configuration comprises a modem board set without the transmitter and is for use with one of the remote transducers.

NOTE The terms "remote modem" and "local modem" are used often in this manual, and their meaning is provided in several places. However, a "remote transducer" is a transducer that connects to a modem, whether it is considered to be a local modem or a remote modem.

Surface Modems

The surface modems, which can be used with any of the remote transducers, include the following:

ATM-891 Deck Box. Connects to a surface host processor and can transmit and receive data at baud rates as high as 15,360 bits/sec.

ATM-880 Module. Designed for installation on surface buoys.

ATM-891 Deck Box

The ATM-891 Deck Box, which is an ATM-890 Series Acoustic Telemetry Modem, is shown in Figure 1-1. The deck box, which is watertight with the cover closed, is used to communicate with any of the subsea modems or SMART Releases, or another deck box, using one of the remote transducers as a dunking transducer. The ATM-891 Deck Box can also activate the release mechanism of a SMART Release. It is powered with 100–120 VAC, 50–60 Hz; 200–240 VAC, 50–60 Hz; or external 21–28 VDC, and includes AC and DC power cables and a choice of a 25, 50 or 100-meter transducer cable. The deck box can be connected to a host processor through its RS-232/422 serial port and includes a speaker and volume control for audio verification of transmitted data. The deck box is also available in a choice three frequency bands: 9–14 kHz (LF), 16–21 kHz (MF) and 25–30 kHz (HF). These configurations provide additional noise filtering for enhanced performance in a noisy operating environment.

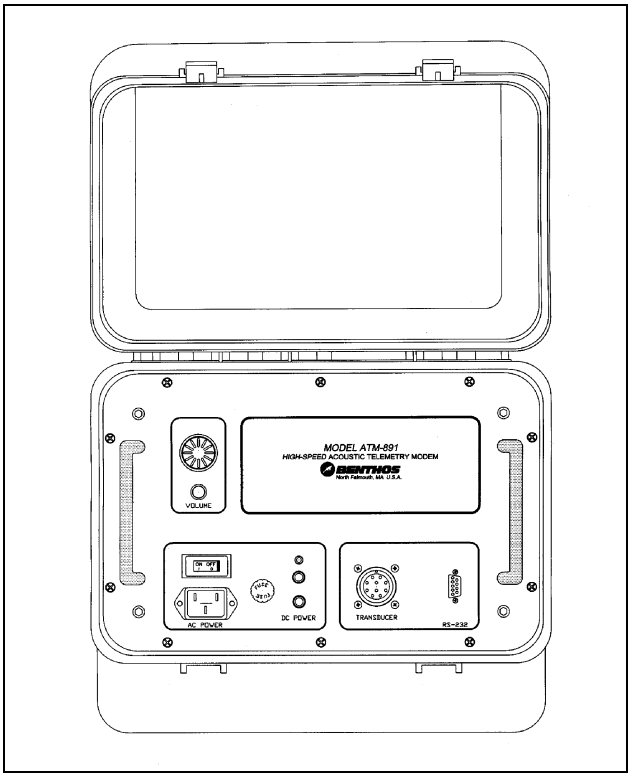


Figure 1-1 The ATM-891 Deck Box

Model ATM-880 Module

The ATM-880 Module, which is an ATM-880 Series Acoustic Telemetry Modem, is designed to be installed on a surface buoy. It is housed in a NEMA weather resistant enclosure and includes a connector for one of the remote transducers, an RS-232 serial port connector for connecting to a host processor on the buoy, and an external DC power connector. When installed on a surface buoy and controlled by the host processor, the modem can communicate with other deployed modems. Information received from those modems is output to the host processor and can be transmitted over an RF link to a remote station. Similarly, the deployed modems can receive information from the remote station.

Subsea Modems

The subsea modems are ATM-880 Series Acoustic Telemetry Modems and consist of five configurations:

ATM-885 Acoustic Telemetry Modem. Includes a built-in omnidirectional or directional transducer and operates to a depth of 2000 m (6560 ft).

ATM-885R Acoustic Telemetry Modem. Connects to a remote transducer and operates to a depth of 2000 m (6560 ft).

ATM-887 Acoustic Telemetry Modem. Includes a built-in directional transducer and operates to a depth of 6000 m (19,680 ft).

ATM-887R Acoustic Telemetry Modem. Connects to a remote transducer and operates to a depth of 6000 m (19,680 ft).

ATM-888 Acoustic Telemetry Modem. Includes a built-in omnidirectional or directional transducer and operates to a depth of 305 m (1000 ft).

ATM-885 and ATM-885R Acoustic Telemetry Modems

The ATM-885 and ATM-885R Acoustic Telemetry Modems are shown in Figure 1-2. The ATM-885 is completely self-contained in a hard coat anodized aluminum housing and includes a modem battery pack and a built-in omnidirectional or directional transducer. The ATM-885R is similar to the ATM-885 but does not include a transducer or a transmitter. Instead, a 2-meter cable pigtail is provided which connects from the transducer connector on the top end cap of the modem to any of the remote transducers.

Both the ATM-885 and the ATM-885R also include a power/serial connector that is installed on the bottom end cap. The connector is used to input external power for powering the modem instead of using its internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.

ATM-887 and ATM-887R Acoustic Telemetry Modems

The ATM-887 and ATM-887R Acoustic Telemetry Modems are shown in Figure 1-3. The ATM-887 is completely self-contained and includes a modem battery pack and a built-in directional transducer that is specifically designed for full ocean depth applications. The ATM-887 modem functions the same as all the other modems. However, the housing, which is constructed of thick-walled hard coat anodized and painted aluminum, is designed for

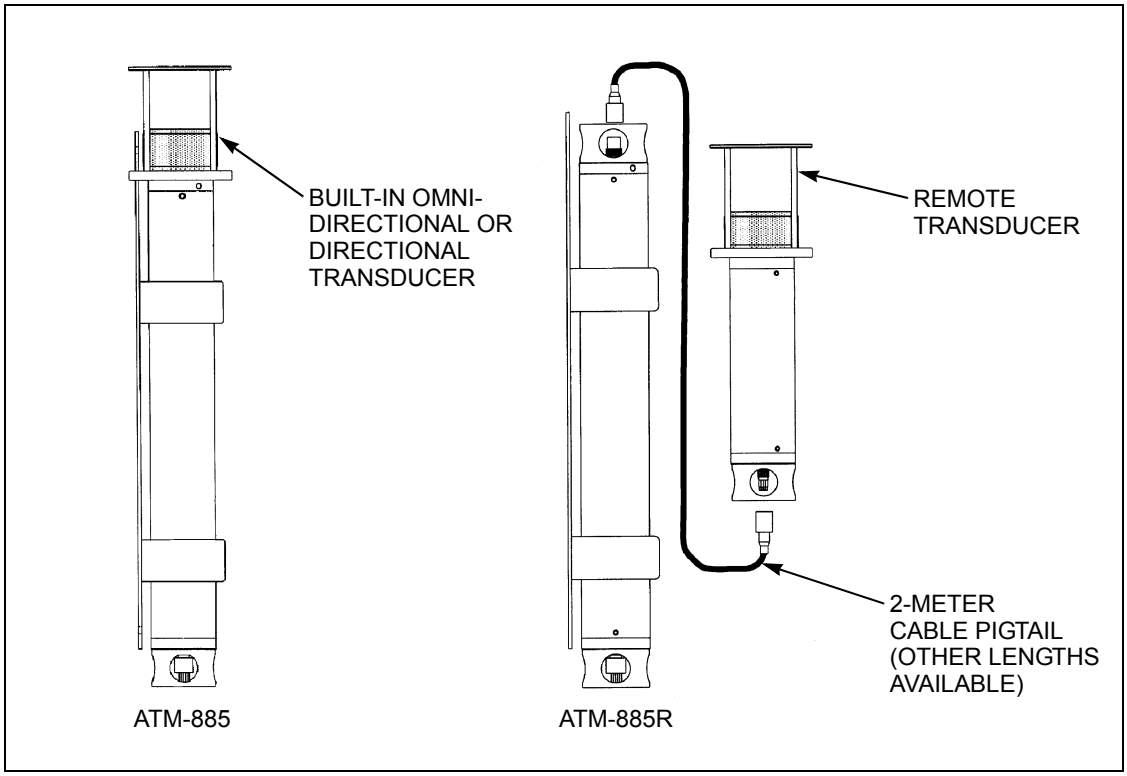


Figure 1-2 ATM-885 and ATM-885R Acoustic Telemetry Modems

deployment to full ocean depth. The ATM-887R is similar to the ATM-887 but does not include a transducer or a transmitter. Instead, a 2-meter cable pigtail is provided which connects from the transducer connector on the top end cap of the modem to an AT-421 remote transducer

Both the ATM-887 and the ATM-887R also include a power/serial connector that is installed on the bottom end cap. The connector is used to input external power for powering the modem instead of using its internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.

ATM-888 Acoustic Telemetry Modem

The ATM-888 Acoustic Telemetry Modem, which is externally powered only, is contained in a PVC housing and includes a built-in omnidirectional or directional transducer. The ATM-888 also includes a power/serial connector that is installed on the bottom end cap. The connector is used to input external power for powering the modem, and to connect to either an RS-232 or an RS-422 serial interface.

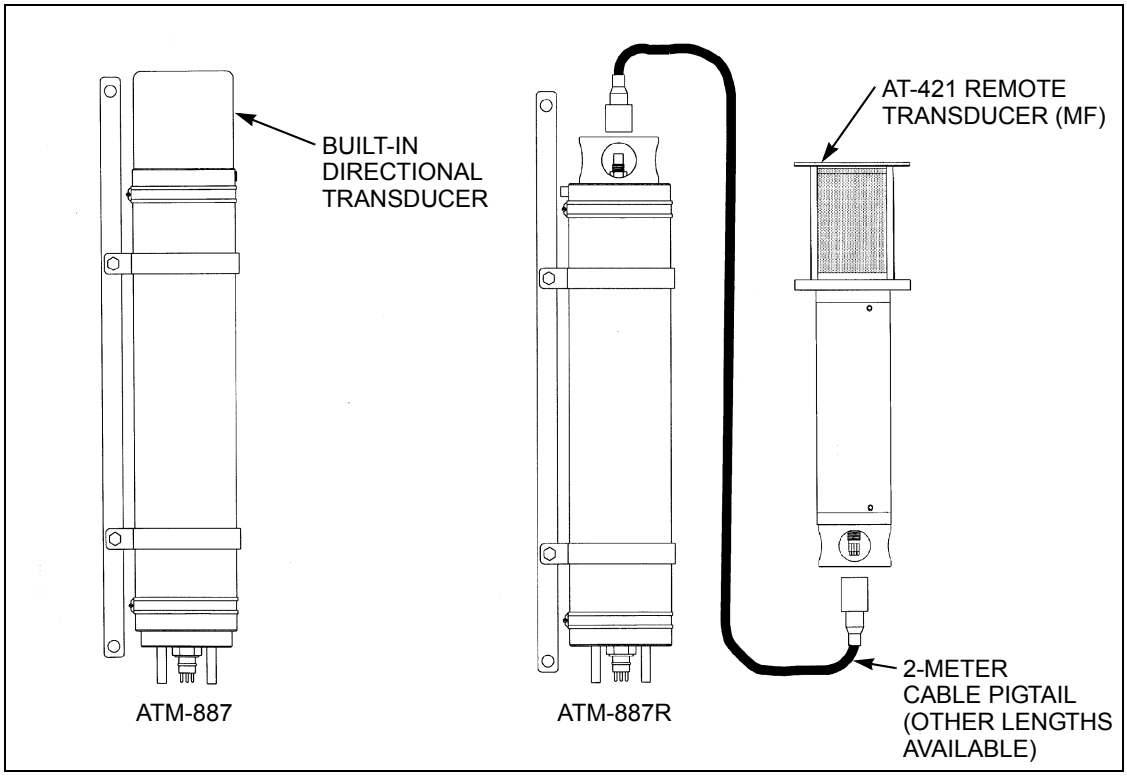


Figure 1-3 ATM-887 and ATM-887R Acoustic Telemetry Modems

SMART Releases

The SMART Releases include the following:

SR-100 SMART Release. Designed for long range, heavy duty applications and operates to a depth of 6000 m (19,680 ft).

SR-100 SMART Release

The SR-100 SMART Release is shown in Figure 1-4. The SR-100 combines the same reliable high torque motorized release mechanism used in the Benthos 865-A Deep Sea Acoustic Release with the same modem technology provided by the Benthos ATM-880 Series Acoustic Telemetry Modems. It is completely self-contained in a hard coat anodized aluminum housing and includes a modem battery pack and a built-in omnidirectional transducer that is specifically designed for full ocean depth applications.

NOTE For detailed information on the Benthos SR-100 SMART Release, refer to the SR-100 SMART Release User Manual.

The SR-100 is designed for long range, heavy duty, deep or shallow water applications. It can support a static load of 4540 kg (10,000 lb), and each release is factory tested to a simulated depth of 11,000 m (36,080 ft). Its primary function is the release of a moored instrument array. In addition, the SR-100 functions to assist in the relocation of itself and the instrument array as it can be commanded to operate as a transponder for measuring slant range. Upon recovery, the SR-100 can be easily re-armed and redeployed.

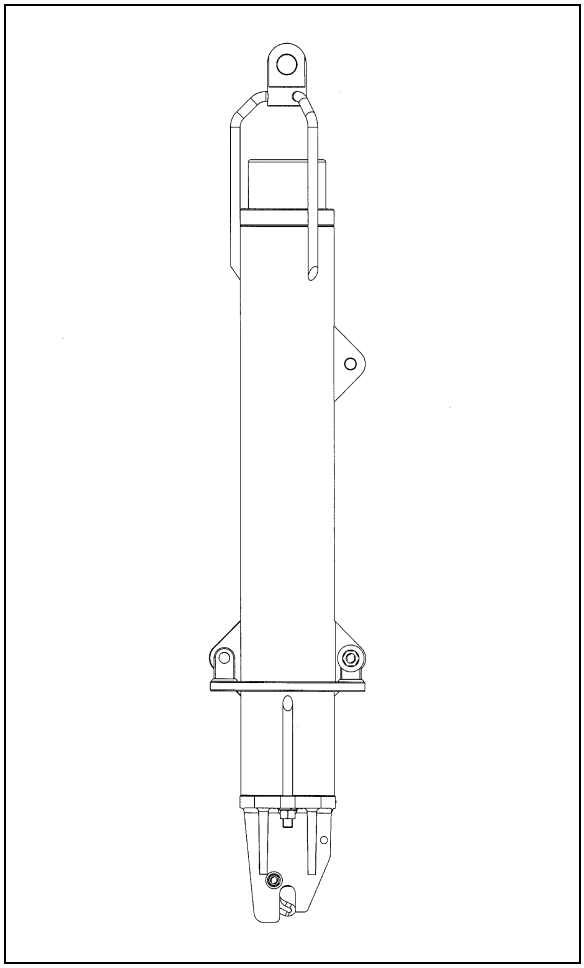


Figure 1-4 The SR-100 SMART Release

Modem Board Sets

The modem board sets are ATM-880 Series Acoustic Telemetry Modems and consist of two configurations:

ATM-885PCB Modem Board Set. Includes a directional or omnidirectional transducer.

ATM-885RPCB Modem Board Set. Connects to a remote transducer.

ATM-885PCB Modem Board Set

The ATM-885PCB Modem Board Set is shown in Figure 1-5. The ATM-885PCB includes a circuit board set mounted to a chassis and an omnidirectional or directional transducer, which is configured with a block mount and a bulkhead connector. It is externally powered and is designed for original equipment manufacture (OEM) applications, where the modem is integrated into a housing or chassis of another manufacturer's design.

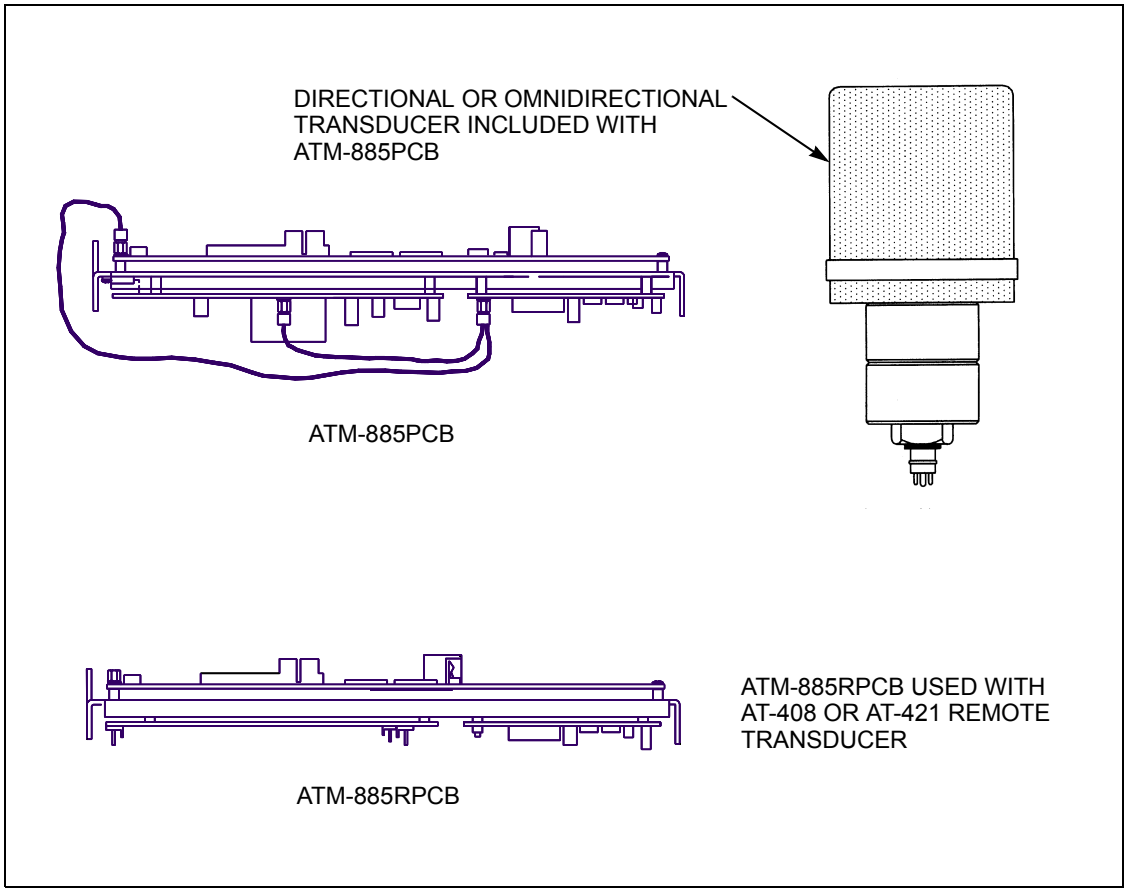


Figure 1-5 ATM-885PCB and ATM-885RPCB Modem Board Sets

ATM-885RPCB Modem Board Set

The ATM-885RPCB Modem Board Set is shown in Figure 1-5. The ATM-885RPCB is externally powered and is for OEM applications. However, the transmitter is not included, as the board set is specifically configured to connect directly to one of the remote transducers.

Remote Transducers

The remote transducers consist of two types:

AT-408 Omnidirectional Transducer. An omnidirectional transducer available in any one of three different frequency bands.

AT-421 Directional Transducer. A directional transducer available in any one of two different frequency bands.

The remote transducers each include a built-in preamplifier and transmitter.

AT-408 Omnidirectional Transducer

The AT-408 Omnidirectional Transducer is available in three frequency bands: 9–14 kHz (LF), 16–21 kHz (MF) and 25–30 kHz (HF). The AT-408 Omnidirectional Transducer provides omnidirectional transmit and receive beam patterns. It is best used in both deep and shallow water applications where the direction of the receiving transducer is not known or is not fixed. However, because of its omnidirectional beam pattern, the directivity index is relatively small, and the multipath is more severe than a directional transducer with the same input power level, as the energy is more widely distributed. The AT-408 Omnidirectional Transducer and its typical vertical beam pattern is shown in Figure 1-6.

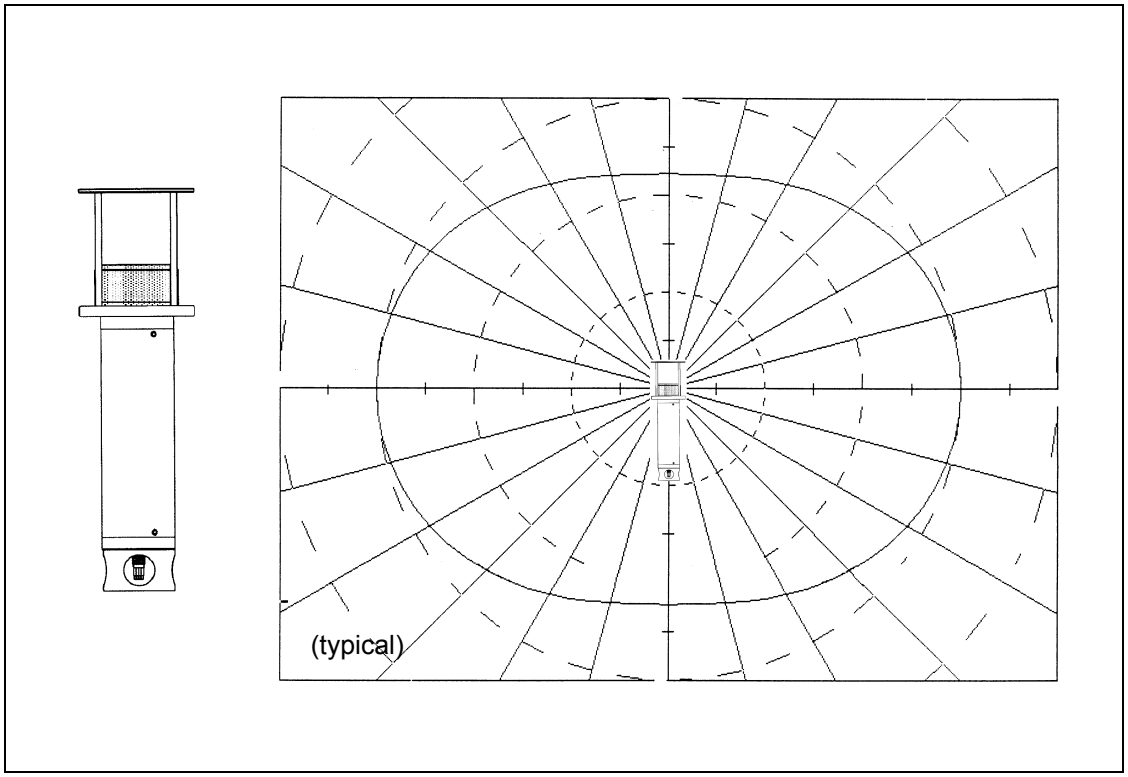


Figure 1-6 AT-408 Omnidirectional Transducer and Beam Pattern

AT-421 Directional Transducer

The AT-421 Directional Transducer is available in two frequency bands: 9–14 kHz (LF) and 16–21 kHz (MF). Whenever possible, the AT-421 Directional Transducer should be used, as it provides conical transmit and receive beam patterns. And because the energy is focused into a narrow

beam, it provides a higher directivity index than an omnidirectional or a line array transducer with the same input power level. The AT-421 Transducer is most effective when used in the vertical channel, or when the transducer can be pointed toward the receiving transducer in the horizontal channel. In the latter case, multipath due to sea surface and sea floor reflections is minimized as most of the energy is directed horizontally. The AT-421 Directional Transducer and its typical vertical beam pattern is shown in Figure 1-7.

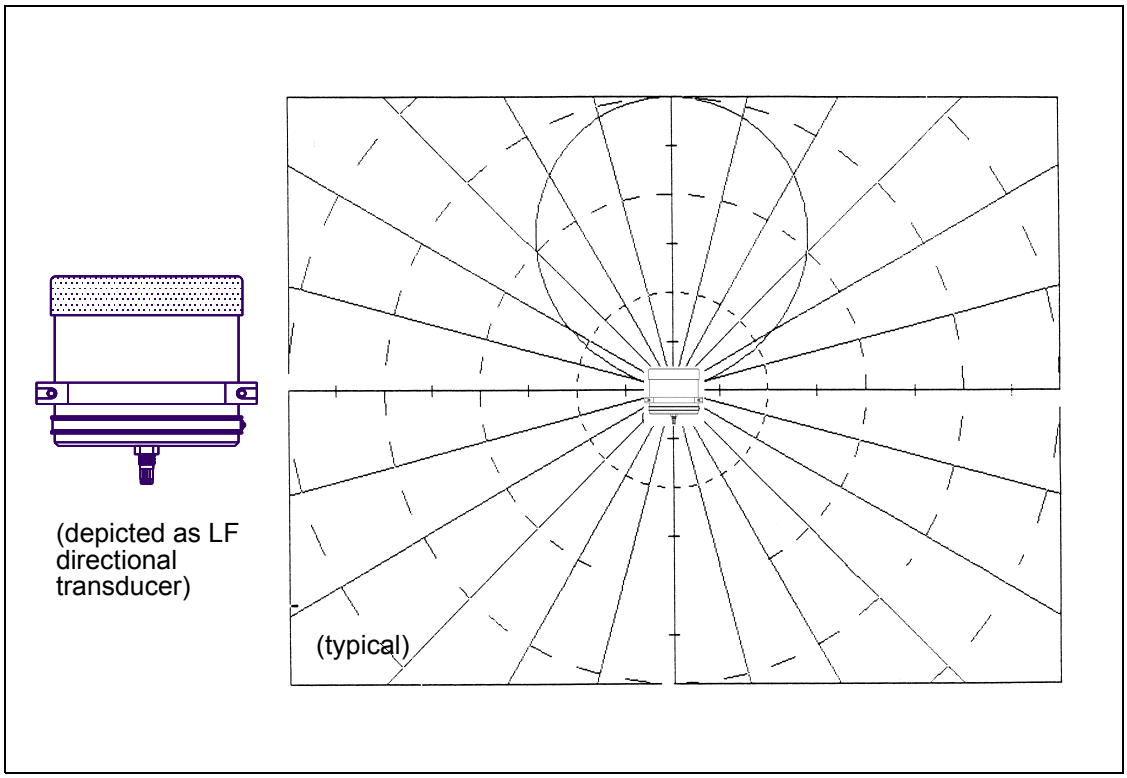


Figure 1-7 AT-421 Directional Transducer and Beam Pattern

Acoustic Baffles

An acoustic baffle, when installed on a remote transducer, effectively reduces the effects of noise or multipath signals that arrive from the back of the transducer. Acoustic baffles are available for all the remote transducers. Refer to "Customer Service" on page vi for information on how to contact Benthos for detailed specifications.

Typical Applications

The ATM-880 and ATM-890 Series Acoustic Telemetry Modems are used in numerous applications. Typical uses include remote data acquisition of real time or stored data from subsea instrument packages, control of wellhead and pipeline valves, and control of autonomous underwater vehicles (AUVs).

Remote Data Acquisition

A common application for the ATM-880 and ATM-890 Series Acoustic Telemetry Modems is the acquisition of real time or stored data from deployed instruments. In this application a subsea modem is deployed with an instrument package, such as a current meter, a Conductivity/ Temperature/Depth (CTD) instrument or a tide gauge. The modem receives data from the instrument over its RS-232/422 serial interface and either immediately transmits the data to a receiving modem or stores the data for transmission later. One example of this application is shown in Figure 1-8,

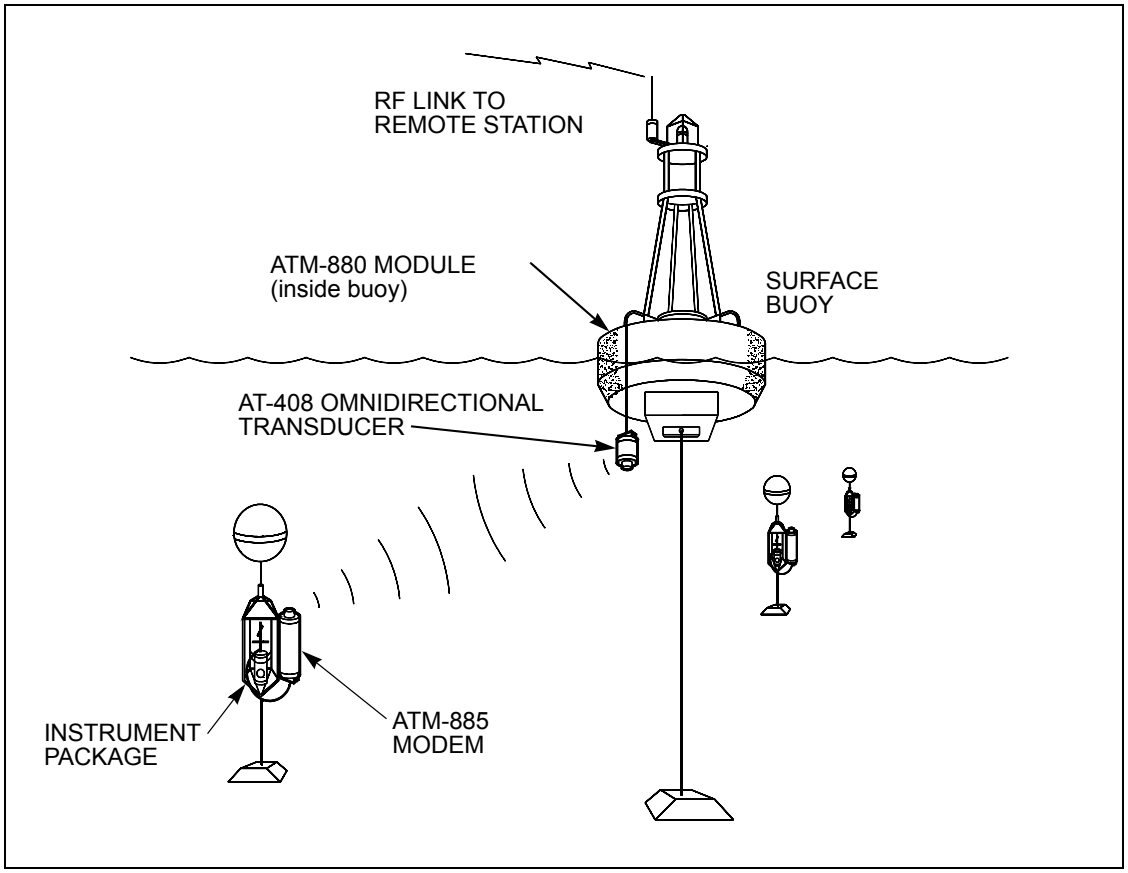


Figure 1-8 Data Acquisition and RF Link to Remote Station

where several ATM-885 Acoustic Telemetry Modems, each of which include a built-in omnidirectional transducer, are deployed with an instrument package. All the modems communicate with an ATM-880 Module installed on a surface buoy. The module connects to an onboard host processor and an AT-408 Omnidirectional Transducer, which is configured as a dunking transducer. Data that are received from the instrument packages are transmitted to a remote station receiver by way of an RF link such as a cellular phone or a satellite connection. Use of modems in this application eliminates the need to install expensive electrical cable between a deployed instrument and a surface buoy. This is especially advantageous when multiple instrumentation packages, which are deployed within the same general area, must communicate by way of the same RF channel.

The ATM-891 Deck Box can be used to retrieve data that have been collected by deployed instruments over a period of time and stored by the modems. An example of this is shown in Figure 1-9, where several deployed instrumentation packages are shown, each connected to an ATM-887 Acoustic Telemetry Modem, which has a built-in directional transducer and can be deployed in water depths up to 6000 m (19,680 ft). The data that are

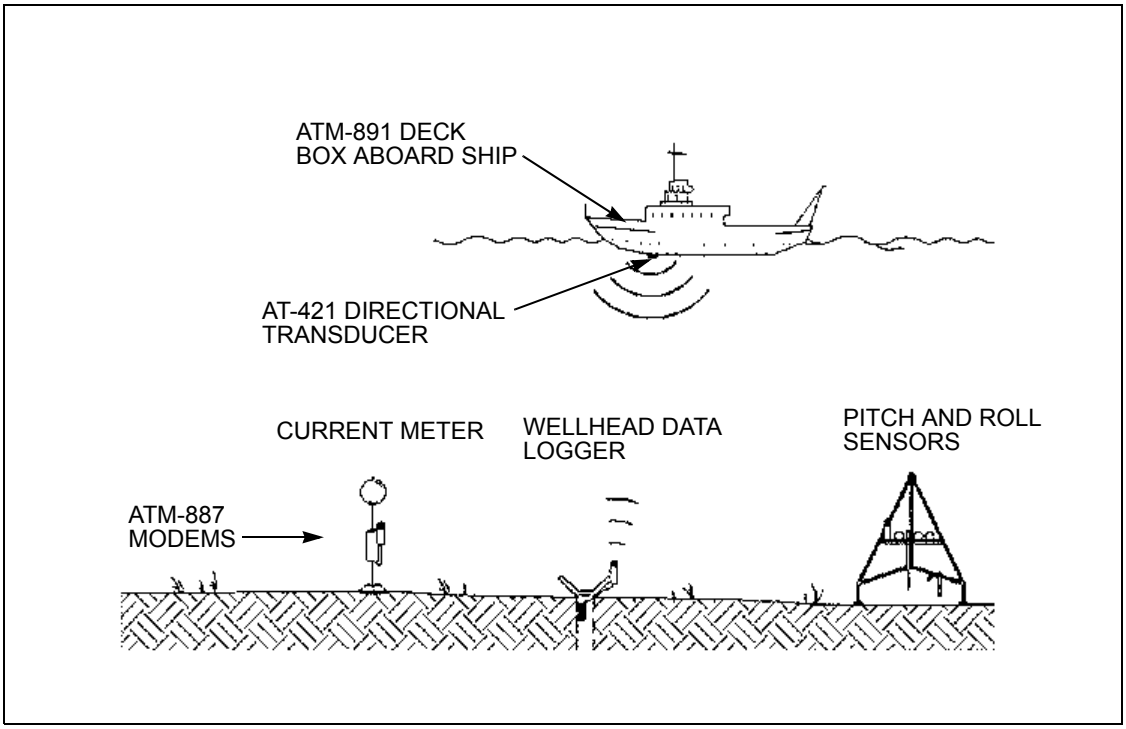


Figure 1-9 Periodic Acquisition of Stored Data

collected by the instruments are stored by the modems over long periods of time and then periodically retrieved. In this application, because directional transducers are used and the transmission medium is the vertical channel, reliable, higher speed communications can be obtained with minimum multipath from sea surface and sea floor reflections.

AUV Command and Control

AUVs can only be controlled by an acoustic link. The ATM-880 and ATM-890 Series Acoustic Telemetry Modems provide this capability by allowing commands to be transmitted to an AUV. Furthermore, since the modems provide two-way communications capability, AUV position and status information, as well as other data can be received from the AUV. An example of this application is shown in Figure 1-10. In this example the modems provide the communications link between an under ice AUV and a surface

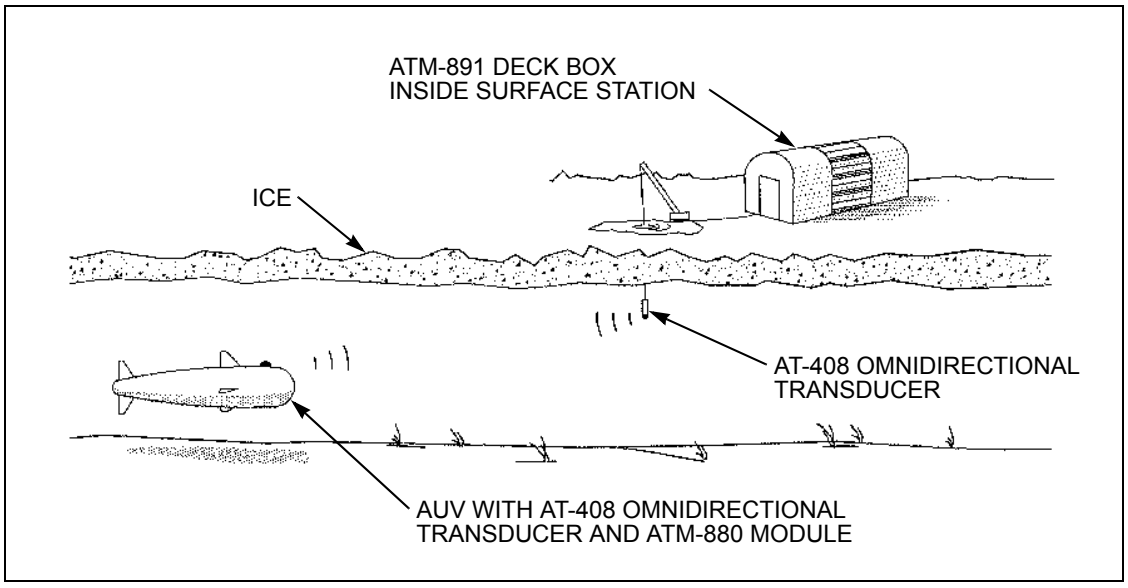


Figure 1-10 Command and Control of an AUV

station. The AT-408 Omnidirectional Transducers used in this example provide a reliable acoustic link between the AUV and the surface station regardless of what depth or from what direction the AUV is located. An ATM-891 Deck Box connected to a host processor is used in the surface station, and an ATM-880 Module and host processor is used aboard the AUV.

Modem Performance Factors

The primary function of modems is to both transmit and receive signals that represent digital data—binary ones and zeros—over what usually is a hard wired link such as a telephone line or a microwave link. In fact, the word modem is derived from the terms modulation and demodulation, which refer to the coding and transmission, and the receiving and decoding of digital data, respectively. Two key factors measure a modem's performance: speed and reliability. Speed is measured by determining the number of bits transmitted per second, which is referred to as the baud rate. Reliability is measured by determining the bit error rate, which is the ratio of the number of bits received in error to the total number of bits transmitted. Except when noise interference is high, modems that transmit and receive data over phone lines or microwave links typically function nearly error free, and at baud rates of 128,000 bits/sec or more. In addition, repeater systems allow virtually unlimited transmission ranges. Those same performance factors are also used to measure the capabilities of the ATM-880 and ATM-890 Series Acoustic Telemetry Modems. However, with the transmission medium being water and the transmitted signals being sound, a number of physical barriers exist that constrain those performance factors, physical barriers that are not present in either wire or microwave links.

Barriers to Underwater Communications

The major factors that constrain the performance of any communications system that uses water as a communications medium are the relatively slow speed of sound in water, the signal fading characteristics due to sound absorption and destructive interference, the multipath interference due to sea surface and sea floor reflections, and reflections from nearby objects.

Sound Speed in Seawater

The speed of sound in seawater, on average, is about 1500 meters/sec. This is compared to electromagnetic signals that are carried on a wire or transmitted as radio signals and travel at nearly the speed of light. However, the relatively slow speed of sound in seawater has no direct effect on the baud rate of the modems; it affects only the time period between the transmission of a signal and its reception. In most applications this delay is not of much concern, as the alternative is to use a hard wired connection, which is sometimes prohibitively expensive or not feasible.

Signal Fading

Signal fading is primarily caused by spreading loss and the absorption of sound in water, but it is also caused by destructive interference due to multipath, a situation where signals of like frequency nearly cancel each other. This frequency dependent fading occurs when a multipath induced reflection of the transmitted signal arrives at the receiving transducer at the same time as a transmitted signal of the same frequency. The result is a reduction in the amplitude of both signals. Signal fading due to spreading loss is a result of the dispersion of energy as it radiates outwardly from the transmitting transducer. And signal fading due to the absorption of sound in water increases with increasing frequency. To a lesser extent, environmental factors such as temperature, pressure, and salinity also affect absorption, and absorption also occurs at the sea floor.

Multipath Interference and Reflections

The factor that most restricts both the baud rate and the reliability of an acoustic modem is multipath. Multipath, which is particularly severe when attempting to communicate over the horizontal channel in shallow water, is the result of sea surface and sea floor reflections, reflections from objects that are near the receiving modem, and refractions from thermal gradients and water turbulence. Using directional remote transducers reduces the effects of multipath when the transducers are aimed at each other, yet reflections from objects such as piers or boats that are near the receiving transducer cause overlapping of the received signals, resulting in decreased reliability. In addition, multipath is usually not stationary; hence even techniques used to track and reduce the effects of multipath do not significantly improve modem performance in increasingly dynamic multipath situations. As a result, multipath forces continual trade-offs in the speed, the reliability, and the cost of acoustic modems.

High Performance Modulation Techniques

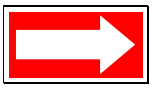
To reduce the effects of the physical barriers to underwater communications and provide high modem performance, the ATM-880 and ATM-890 Series Acoustic Telemetry Modems employ both PSK and MFSK modulation techniques.

PSK modulation allows the modems to operate at up to 15,360 bits/sec. It also has high bandwidth efficiency and is primarily used when multipath interference is generally minimal, such as in the vertical channel. The ATM-890 Series uses PSK modulation to both transmit and receive data. The ATM-880 Series can transmit data using PSK modulation, but receives data using MFSK modulation only.

MFSK modulation is a spread spectrum modulation process that transmits multiple tones simultaneously. MFSK has a maximum baud rate of 2400 bits/sec and has good reliability even in a high multipath environment.

Methods for Increasing Reliability

Three methods are provided by the ATM-880 and ATM-890 Series Acoustic Telemetry Modems to increase communications reliability: convolutional coding, multipath guard period, and data redundancy. Convolutional coding uses error correcting algorithms that are determined from the data that are to be transmitted. Multipath guard period, which is used only with MFSK modulation, provides a short delay between data frames to allow for the dispersion of the multipath signals. And data redundancy essentially repeats the transmission of a series of data bits.



NOTE Both the modulation technique and the method or combination of methods for increasing reliability are implemented automatically by the modems, depending on the selected baud rate. To see which technique and method are selected for each of the available baud rates, refer to "Acoustic Baud Rate S4" on page 7-11. The selections are listed under "Available Settings." How to select the baud rate, both when using TelesonarPC and directly by using modem commands, is explained later in this manual.

Convolutional Coding

Convolutional coding is the most effective of the thee methods provided for increasing reliability. The convolutional coding method used is 1/2 rate convolutional coding. In 1/2 rate convolutional coding, every eight data bits are followed by eight additional bits, which are encoded from the data bits using a convolutional encoding algorithm. This convolutional code, when decoded by the receiving modem using a Viterbi decoding algorithm, is used to correct at least one error bit—if there are any—in the eight bits of data. The *effective* baud rate—or throughput, however, is reduced by half since for every 16 bits transmitted, only eight are data bits.

Multipath Guard Period

To further increase reliability, especially in high multipath situations where signal overlap can occur, a selectable delay can be inserted between data frames. The delay is selected based on the length of time the multipath is present in the communications channel. Again, the baud rate is affected. Multipath guard period is not used with the PSK modulation technique.

For example, a multipath guard period of 25 milliseconds adds 25 milliseconds to the duration of each data frame, which is also 25 milliseconds; hence the baud rate is reduced to half of what it is without the multipath guard period. For a multipath guard period of 12.5 milliseconds, the baud rate is reduced to two thirds.

Data Redundancy

Data redundancy, which is also referred to as frequency diversity, is a method whereby the same data bits are transmitted two or more times in the same data frame.

For example, if the baud rate is 600 bits/sec, a data redundancy of two reduces the effective baud rate to half this rate, or 300 bits/sec.

2 Specifications

This section provides the specifications for the Benthos ATM-880 and ATM-890 Series Acoustic Telemetry Modems, including the remote transducers and the modem battery packs.

General

The general specifications apply to all of the ATM-880 and ATM-890 Series Acoustic Telemetry Modems.

Frequency bands:	9–14 kHz (LF), 16–21 kHz (MF) and 25–30 kHz (HF)
Data modulation:	PSK and MFSK
Baud rate:	2560–15,360 bits/sec (PSK transmit); 140–2400 bits/sec (MFSK transmit and receive)
Addressable modems:	100
Processing features:	Data redundancy 1/2 rate convolutional coding Multipath guard period
Operating temperature:	-5°C to 50°C
Storage temperature:	-45°C to 85°C
Serial interface:	RS-232/422 at 9600, 4800, 2400, or 1200 baud
Flow control:	RS-232—hardware RTS/CTS handshaking or software XON/XOFF RS-422—software XON/XOFF handshaking

ATM-891 Deck Box

The ATM-891 Deck Box connects to any of the remote transducers and is used to communicate with the subsea modems or another deck box. In addition, a host processor can be connected to the deck box through an RS-232/422 serial interface. The deck box is also available in a choice three frequency bands: 9–14 kHz (LF), 16–21 kHz (MF) and 25–30 kHz (HF).

Physical Characteristics

Case construction:	Watertight with cover closed
Dimensions:	25.4 cm (10.0 in.) high by 35.6 cm (14.0 in.) wide by 16.5 cm (6.5 in.) deep
Weight:	5 kg (11 lb)
Transducer cable:	25 m (82 ft) length standard, 50 m (164 ft) and 100 m (328 ft) optional, 545 kg (1200 lb) breaking strength

Power Requirements

AC input power:	100–120 VAC, 50–60 Hz, 50 watts typ; 200–240 VAC, 50–60 Hz, 50 watts typ; auto sensing
External DC input power:	21–28 V
DC input current (when not transmitting):	160 mA typ, 250 mA max @ 21 V
DC input current (when transmitting)	1 A average, 3 A peak @ 21 V (MF, HF) 2 A average, 5 A peak @ 21 V (LF)

Input/Output

Operator controls:	Speaker volume control Power on/off switch
Displays and indicators:	Power on/off indicator Speaker

Power:	AC power input DC power input
Signal:	RS-232/422 serial interface (data) Transducers (AT-408 or AT-421)

Transducers

Available types:	AT-408 omnidirectional (LF, MF and HF) AT-421 directional (LF and MF)

ATM-885 Subsea Modem

The ATM-885 Acoustic Telemetry Modem is a completely self contained subsea modem with a built-in omnidirectional or directional transducer and an internal modem battery pack. The modem can operate either on its internal battery pack or on external DC power.

Physical Characteristics

Housing construction:	Hard coat anodized aluminum
Dimensions:	14.0 cm (5.5 in.) max diameter by 85.1 cm (33.5 in.) long
Mounting:	Stainless steel sidebar
Weight in air:	11 kg (24 lb)
Weight in water:	5 kg (11 lb)
Operating depth:	2000 m (6560 ft)

Power Requirements

Modem battery pack:	21 V, 18 A·h
External DC input power:	14–28 V
Lowpower state current:	0.5 mA typical, 1.0 mA maximum
DSP/receiver current, active:	25 mA typical
Transmitter current, active:	1 A average, 3 A peak @ 21 V (MF, HF) 2 A average, 5 A peak @ 21 V (LF)

Input/Output

Operator controls: Plunger type on/off switch

Power: External DC power input

Signal: RS-232/422 serial interface (data)

Device enable: Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Type: Built-in LF, MF or HF omnidirectional, or MF directional

Source level @ 21 V (typ.): 178 dB re 1 µPa @ 1 m (3.28 ft) for MF and HF omnidirectional

185 dB re 1 µPa @ 1 m (3.28 ft) for LF omnidirectional

190 dB re 1 µPa @ 1 m (3.28 ft) for LF and MF directional

Source level @ 14 V (typ.): -3 dB down from source level at 21 V

ATM-885R Subsea Modem

The ATM-885R Acoustic Telemetry Modem is a subsea modem that includes an internal modem battery pack and connects to any of the remote transducers with a supplied 2-meter cable. The modem can operate either on its internal battery pack or on external DC power.

Physical Characteristics

Housing construction: Hard coat anodized aluminum

Dimensions: 8.9 cm (3.5 in.) max diameter by 75.4 cm (29.7 in.) long

Mounting: Stainless steel sidebar

Weight in air:	11 kg (24 lb)
Weight in water:	5 kg (11 lb)
Operating depth:	2000 m (6560 ft)

Power Requirements

Modem battery pack:	21 V, 18 A·h
External DC input power:	14–28 V
Lowpower state current:	0.5 mA typical, 1.0 mA maximum
DSP/receiver current, active:	25 mA typical
Transmitter current, active:	1 A average, 3 A peak @ 21 V (MF, HF) 2 A average, 5 A peak @ 21 V (LF)

Input/Output

Operator controls:	Plunger type on/off switch
Power:	External DC power input
Signal:	RS-232/422 serial interface (data) Transducers (AT-408 or AT-421)
Device enable:	Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Available types:	AT-408 omnidirectional (LF, MF and HF) AT-421 directional (LF and MF)

ATM-887 Subsea Modem

The ATM-887 Acoustic Telemetry Modem is a completely self contained 6000-meter depth rated subsea modem with a built-in medium frequency (MF) directional transducer and an internal modem battery pack. The modem can operate either on its internal battery pack or on external DC power.

Physical Characteristics

Housing construction:	Hard coat anodized and painted aluminum
Dimensions:	12.7 cm (5.0 in.) max diameter by 85.3 cm (33.6 in.) long
Mounting:	Stainless steel sidebar
Weight in air:	16.4 kg (36 lb)
Weight in water:	7.7 kg (17 lb)
Operating depth:	6000 m (19,680 ft)

Power Requirements

Modem battery pack:	21 V, 28 A·h
External DC input power:	14–28 V
Lowpower state current:	0.5 mA typical, 1.0 mA maximum
DSP/receiver current, active:	25 mA typical
Transmitter current, active:	1 A average, 3 A peak @ 21 V (MF, HF) 2 A average, 5 A peak @ 21 V (LF)

Input/Output

Operator controls:	Plunger type on/off switch
Power:	External DC power input
Signal:	RS-232 serial interface (data)
Device enable:	Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Type:	Built-in MF directional
Source level @ 21 V (typ.):	190 dB re 1 μPa @ 1 m (3.28 ft)
Source level @ 14 V (typ.):	187 dB re 1 μPa @ 1 m (3.28 ft)

ATM-887R Subsea Modem

The ATM-887R Acoustic Telemetry Modem is a 6000-meter depth rated subsea modem that includes an internal modem battery pack and connects to an AT-421 Directional Transducer with a supplied 2-meter cable. The modem can operate either on its internal battery pack or on external DC power.

Physical Characteristics

Housing construction:	Hard coat anodized and painted aluminum
Dimensions:	12.7 cm (5.0 in.) max diameter by 71.9 cm (28.3 in.) long
Mounting:	Stainless steel sidebar
Weight in air:	16.4 kg (36 lb)
Weight in water:	7.7 kg (17 lb)
Operating depth:	6000 m (19,680 ft)

Power Requirements

Modem battery pack:	21 V, 28 A·h
External DC input power:	14–28 V
Lowpower state current:	0.5 mA typical, 1.0 mA maximum
DSP/receiver current, active:	25 mA typical
Transmitter current, active:	1 A average, 3 A peak @ 21 V (MF, HF) 2 A average, 5 A peak @ 21 V (LF)

Input/Output

Operator controls:	Plunger type on/off switch
Power:	DC power input
Signal:	RS-232 serial interface (data) Transducer (AT-421)

Device enable: Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Available types: AT-421 directional (LF and MF)

ATM-888 Subsea Modem

The ATM-888 Acoustic Telemetry Modem is subsea modem with a built-in omnidirectional or directional transducer. The modem operates on external DC power only.

Physical Characteristics

Housing construction: PVC

Dimensions: 11.4 cm (4.5 in.) max diameter by 43.2 cm (17.0 in.) long

Mounting: Fiberglass strongback

Weight in air: 3.2 kg (7 lb)

Weight in water: Neutrally buoyant

Operating depth: 305 m (1000 ft)

Power Requirements

External DC input power: 14–28 V

Lowpower state current: 0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A average, 3 A peak @ 21 V (MF, HF)
2 A average, 5 A peak @ 21 V (LF)

Input/Output

Power: External DC power input

Signal: RS-232/422 serial interface (data)

Device enable: Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Type: Built-in LF, MF or HF omnidirectional, or MF directional

Source level @ 21 V (typ.): 178 dB re 1 μPa @ 1 m (3.28 ft) for MF and HF omnidirectional

185 dB re 1 μPa @ 1 m (3.28 ft) for LF omnidirectional

190 dB re 1 μPa @ 1 m (3.28 ft) for LF and MF directional

Source level @ 14 V (typ.): -3 dB down from source level at 21 V

ATM-885PCB Modem Board Set

The ATM-885PCB Modem Board Set includes both a circuit board set mounted to a chassis and a directional or omnidirectional transducer. It is externally powered and is designed for OEM applications.

Physical Characteristics

Chassis Dimensions: 7.1 cm (2.8 in.) wide by 6.6 cm (2.6 in.) high by 22.3 cm (8.8 in.) long

Mounting: Chassis mounting holes

Power Requirements

External DC input power: 14–28 V

Lowpower state current: 0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A average, 3 A peak @ 21 V (MF, HF)
2 A average, 5 A peak @ 21 V (LF)

Input/Output

Power: External DC power input

Signal: RS-232/422 serial interface (data)
Transducers (LF, MF or HF)

Device enable: Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Type: LF, MF or HF omnidirectional, or MF directional

Source level @ 21 V (typ.): 178 dB re 1 μPa @ 1 m (3.28 ft) for MF and HF omnidirectional

185 dB re 1 μPa @ 1 m (3.28 ft) for LF omnidirectional

190 dB re 1 μPa @ 1 m (3.28 ft) for LF and MF directional

Source level @ 14 V (typ.): -3 dB down from source level at 21 V

ATM-885RPCB Modem Board Set

The ATM-885RPCB Modem Board Set includes a circuit board set mounted to a chassis and is specifically configured to connect directly to any of the remote transducers. It is externally powered and is designed for OEM applications.

Physical Characteristics

Chassis Dimensions: 7.1 cm (2.8 in.) wide by 6.6 cm (2.6 in.) high by 22.3 cm (8.8 in.) long

Mounting: Chassis mounting holes

Power Requirements

External DC input power: 14–28 V

Lowpower state current: 0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A average, 3 A peak @ 21 V (MF, HF)
2 A average, 5 A peak @ 21 V (LF)

Input/Output

Power: External DC power input

Signal: RS-232/422 serial interface (data)
Transducers (AT-408 or AT-421)

Device enable: Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Available types: AT-408 omnidirectional (LF, MF and HF)
AT-421 directional (LF and MF)

AT-408 Omnidirectional Transducer

The AT-408 is an omnidirectional transducer with a built-in preamplifier and transmitter. It can be used as a dunking transducer with the ATM-891 Deck Box or as a remote transducer with the ATM-885R Acoustic Telemetry Modem or the ATM-885RPCB Modem Board Set.

Frequency bands: 9–14 kHz (LF), 16–21 kHz (MF) or
25–30 kHz (HF)

Source level @ 21 V (typ.): 178 dB re 1 µPa @ 1m (MF, HF)
185 dB re 1 µPa @ 1m (LF)

Source level @ 14 V (typ.): - 3 dB down from source level at 21 V

Preamp gain: 35 dB

Radiation pattern:	Omnidirectional
Housing construction:	Anodized aluminum
Dimensions:	14.0 cm (5.5 in.) max diameter by 43.8 cm (17.3 in.) long
Weight in air:	18.7 kg (8.5 lb)
Weight in water:	5.5 kg (2.5 lb)
Operating depth:	2000 m (6560 ft); 6000 m (19,680 ft) optional

AT-421 Directional Transducer

The AT-421 is a directional transducer with a built-in preamplifier and transmitter. It can be used as a dunking transducer with the ATM-891 Deck Box or as a remote transducer with the ATM-885R or ATM-887R Acoustic Telemetry Modem or the ATM-885RPCB Modem Board Set.

Frequency bands:	9–14 kHz (LF) or 16–21 kHz (MF)
Source level @ 21 V (typ.):	190 dB re 1 μPa @ 1 m (3.28 ft)
Source level @ 14 V (typ.):	187 dB re 1 μPa @ 1 m (3.28 ft)
Preamp gain:	35 dB
Radiation pattern:	40° conical (LF) 60° conical (MF)
Housing construction:	Anodized aluminum
Dimensions:	20.3 cm (8.0 in.) max diameter by 25.4 cm (10.0 in.) long (LF) 14.0 cm (5.5 in.) max diameter by 43.8 cm (17.3 in.) long (MF)
Weight in air:	11.8 kg (26 lb) (LF) 5.5 kg (12 lb) (MF)
Weight in water:	3.6 kg (8 lb) (LF) 2.5 kg (5.5 lb) (MF)

Operating depth: 6000 m (19,680 ft) (LF)

2000 m (6560 ft); 6000 m (19,680 ft) optional (MF)

Modem Battery Packs

Two battery packs are available. One is specifically used for the ATM-885 and ATM-885R Acoustic Telemetry Modems, and the other for the ATM-887 and ATM-887R Acoustic Telemetry Modems. They differ only in their size and amp-hour capacity. Both packs use alkaline batteries.

Modem Battery Pack for ATM-885/885R Acoustic Telemetry Modems

Capacity: 18 A·h @ 21°C

Open circuit voltage: 21 V

Modem Battery Pack for ATM-887/887R Acoustic Telemetry Modems

Capacity: 28 A·h @ 21°C

Open circuit voltage: 21 V

3 Deployment Considerations

A number of factors must be considered before deploying an ATM-880 or ATM-890 Series Acoustic Telemetry Modem. These include the choice of a remote transducer, the required operating depth, the required communications range, the multipath and noise conditions, and the physical protection of the modems. This section reviews these factors and also presents some typical installation configurations for the modems.

Remote Transducer Selection

When an ATM-885R, an ATM-887R, or an ATM-885RPCB Acoustic Telemetry Modem, each of which use a remote transducer, is to be installed, the type of remote transducer to use should be carefully selected to best suit the application. Refer to "Remote Transducers" on page 1-8 for general information on the available remote transducers, and to Section 2, "Specifications," for detailed specifications. Also refer to Section 9, "Drawings," for dimensioned outline drawings.

The AT-408 Omnidirectional Transducer and its beam pattern are shown in Figure 1-6 on page 1-9. Its beam pattern shows that it transmits and receives signals equally well in a wide hemispherical pattern. This transducer should be selected when the horizontal direction or the depth of the receiving modem is not known or is not always the same. However, more power is required compared to a directional transducer to produce an equivalent source level, and the effects of multipath are usually greater.

The AT-421 Directional Transducer and its beam pattern are shown in Figure 1-7 on page 1-10. Whenever possible, this transducer should be selected. Its transmit and receive beam patterns are that of a narrow cone; hence it is a good choice when the depth and direction of the receiving modem is known and is stable, and the transducer can be pointed at the receiving modem. This transducer requires the least amount of power to produce the equivalent source level of an omnidirectional transducer, and it provides the best protection against the effects of multipath.

Modem Battery Pack

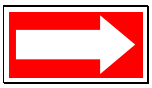
For the subsea modems that use a modem battery pack, the capacity of the battery pack determines both the amount of data a modem can transmit and the modem's useful deployment life.

Battery Pack Currents

In the lowpower state, where the modem is switched on but is inactive, a very small amount of current is drawn from the modem battery pack, typically from 0.5 mA to a maximum of 1.0 mA. Therefore, the modem battery pack can provide power in the lowpower state for over 3 years. However, when the DSP and the receiver are active, hence not in the lowpower state, a relatively large amount of current is drawn from the modem battery pack while the modem receives data or commands, typically 25 mA. The most current is drawn when the modem is transmitting, typically 1 A to a maximum of 2 A. Therefore, unless a modem is to be deployed for well over a year with few transmissions, it is the amount of data to be transmitted that determines its useful deployment life.

Processing Overhead

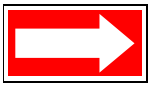
When transmitting a packet of data, which is the entire contents of one of the four available internal 4-kbyte transmit data buffers, an additional 2 bytes are transmitted and the transmitter remains active an additional 1.2 seconds over that required to transmit the actual data. The same is true if only a partial packet is transmitted. Refer to "Transmit Data Buffers" on page 6-3 for information on the four 4-kbyte transmit data buffers. The additional bytes constitute the processing overhead and should be taken into account when transmitting a small amount of data many times.



NOTE TelesonarPC provides a convenient method for calculating the modem battery pack capacity required for various deployment conditions. Refer to "Battery Pack Capacity Usage and Deployment Length Calculations" on page 5-11 for more information.

Modem Battery Pack Capacity Calculations

The modem battery pack, which uses alkaline batteries, provides an output of 21 V and a capacity of either 18 A·h at 21°C for an ATM-885 or ATM-885R, or 28 A·h at 21°C for an ATM-887 or ATM-887R Acoustic Telemetry Modem.



NOTE The capacity of stored alkaline batteries decreases by approximately 5% per year at 21°C. When supplying power to a load in a 0°C environment, the capacity of alkaline batteries decreases by 25%. Therefore, do not use a modem battery pack that is greater than two years old, and replace any modem battery pack that measures less than 90% of its rated capacity, unless a very short deployment is planned.

Verifying the Modem Battery Pack Capacity for a Short Deployment

To verify that the modem battery pack has adequate capacity for the amount of data to be transmitted during a short deployment of 30 days or less, first determine the baud rate that is to be used. Then, referring to Section 2, "Specifications," determine the transmitter active current. For a short deployment the lowpower state current can be neglected. The required capacity in amp-hours can be calculated by using the following equation:

$$\text{Amp-hours} = D \times A/(R \times 450)$$

Where

D = the amount of data to be transmitted in bytes

A = the transmitter active current in amperes

R = the baud rate in bits/second

The constant 450 is derived from the conversions 8 bits/byte and 3,600 seconds/hour.

For example, an ATM-885R Acoustic Telemetry Modem will be used during a short deployment in a 21°C environment to transmit 3 Mbytes of data at 1200 bits/sec. Since the transmitter active current is 1 A, the capacity requirement of the modem battery pack is:

$$\text{Amp-hours} = (3 \text{ Mbytes})[(1 \text{ A}/(1200 \text{ bits/sec} \times 450)]$$

$$= 5.6 \text{ A·h}$$

Referring to "Modem Battery Packs" on page 2-13, it can be seen that a modem battery pack for an ATM-885R Acoustic Telemetry Modem is more than adequate.

An Example Deployment Calculation

The example below shows how to calculate the number of deployment days an ATM-885R Acoustic Telemetry modem can operate when it is required to transmit 500 bytes of data every 30 minutes and the modem is powered with a modem battery pack. The deployment conditions are the following:

Baud rate:	600 bits/sec
Temperature:	0°C
Modem battery pack capacity:	18 A·h
Transmitter current, active:	1 A
DSP/receiver current, active:	25 mA
Lowpower state current:	0.5 mA

The capacity of a modem battery pack is reduced by approximately 25% when exposed to a 0°C environment. Hence the capacity of an 18 A·h modem battery pack is reduced by 25% from 18 A·h to 13.5 A·h, and a 28 A·h modem battery pack provides 21 A·h at 0°C.

The calculation of the number of deployment days at the required transmission rate of 500 bytes every 30 minutes is performed as follows:

First, calculate the number of bytes that can be transmitted, assuming, for now, that the lowpower state current can be neglected.

From the equation

$$\text{Amp-hours} = D \times A/(R \times 450)$$

D becomes

$$D = [\text{amp-hours} \times (R \times 450)]/1\ A$$
$$= (13.5\ A{\cdot}h)(600\ \text{bits/sec} \times 450)/1\ A$$
$$= 3{,}645{,}000\ \text{bytes}$$

To account for the processing overhead when transmitting a packet of data, where in this case a single packet is 500 bytes, an additional 2 bytes of data per packet must be added along with 1.2 seconds of transmitter active time. However, to simplify the calculations, the 1.2 seconds can be converted into equivalent bytes using the 600 bits/second baud rate and the 8 bits/byte conversion:

Equivalent bytes = (1.2 sec x 600 bits/sec)/(8 bits/byte)

= 90 bytes

Now, the total bytes to be transmitted per packet is

500 + 2 + 90 = 592 bytes/packet

Hence the total number of packets that can be transmitted is

Total number of packets = (3,645,000 bytes)/(592 bytes/packet)

= 6,157 packets

And since 1 packet of data transmitted every 30 minutes is equivalent to 48 packets transmitted per day, the total number of deployment days is

Total deployment days = (6,157 packets)/(48 packets/day)

= 128.3 days

However, for long deployments the lowpower state current must be considered. Therefore, the modem battery pack capacity required for the lowpower state is

Lowpower state amp-hours = (deployment time in hours)(500 μA)

= (128.3 days)(24 hours/day)(500 μA)

= 1.54 A·h

Hence the original 13.5 amp-hour calculation must now be reduced by 1.54 amp-hours to 11.96 amp-hours and the total number of days recalculated.

D = (11.96 A·h)(600 bits/sec x 450)/(1 A)

= 3,229,220 bytes

and the total number of packets is now

Total number of packets = (3,229,220 bytes)/(592 bytes/packet)

= 5,454 packets

And again, since 1 packet of data transmitted every 30 minutes is equivalent to 48 packets transmitted per day, the total number of deployment days is now

Total deployment days = (5,454 packets)/(48 packets/day)

= 113.6 days

Modem Operating Depth

The rated operating depth of the subsea modems and remote transducers is typically 2000 meters. However, the ATM-887 and ATM-887R Acoustic Telemetry Modems, and the AT-421 Directional Transducer (LF) are rated to 6000 meters. For custom applications a higher depth rating can be provided. Refer to "Customer Service" on page vi for information on how to contact Benthos should a higher rating be required.

WARNING Do not subject a subsea modem or remote transducer to a depth that exceeds its rating as damage or destruction of the modem could occur.

Modem Communications Range

The communications range between two ATM-880 or ATM-890 Series Acoustic Telemetry Modems depends on many factors: the transmitting modem's source level, the depth of the modems, the transducer orientations, the operating frequency band, the beam pattern of the transducers, the multipath and ambient noise conditions, and other factors. In general, horizontal ranges of two to three kilometers are typical with omnidirectional transducers and can be extended with the use of directional transducers. When the installation and environmental conditions are known, the approximate expected range can be estimated.

Multipath and Noise

Because of the advanced modulation schemes used by the ATM-880 and ATM-890 Series Acoustic Telemetry Modems, reliable operation can be obtained even in relatively severe multipath and noise conditions, but usually at the expense of a reduced baud rate. Refer to "High Performance Modulation Techniques" on page 1-16 for an explanation of the modulation schemes. However, paying particular attention to the modems' remote transducer orientations, their height above the bottom, or their depth below the surface, can reduce the effects of multipath and ambient noise. In some instances the use of acoustic baffles can further improve performance. In addition, the operating frequencies of other acoustic equipment in the area are an important consideration when attempting to achieve optimum performance from the modems.

Transducer Orientation

If possible, when using the AT-421 Directional Transducer, orient the transducer such that it is pointing toward the receiving modem. When using an AT-408 Omnidirectional Transducer, which has an omnidirectional beam pattern, the potential for multipath is the greatest, yet it is not required to point the transducer at the receiving modem.

Use of an Acoustic Baffle

For installations with relatively high multipath and ambient noise conditions, such as surface and bottom multipath reflections, ship noise, sea state noise, and other nearby acoustical noise sources, an acoustic baffle can be installed on the transducer. The acoustic baffle minimizes the effects of multipath signals and noise sources that arrive from behind the remote transducer. Acoustic baffles are available for all the remote transducers. Refer to "Customer Service" on page vi for information on how to contact Benthos for detailed specifications.

Height Above the Bottom and Distance Below the Surface

Adjusting the height of the remote transducer above the bottom for fixed bottom installations can reduce the effects of multipath. Generally, raising a transducer that is close to the bottom such that it is two or three meters above the bottom will usually reduce multipath from bottom reflections. Similarly, for a remote transducer that is near the surface, lowering the transducer will generally reduce the effects multipath from surface reflections, and reduce the effects of both ship noise and surface noise.

Other Acoustic Equipment

If there is other active acoustic equipment in the vicinity of a modem which transmit at frequencies within or near the operating frequency of the modems, modem performance will likely be reduced. The installation and use of other equipment near a modem should be carefully considered prior to and after installing and deploying a modem.

Typical Deployment Configurations

The deployment configurations for the ATM-880 and ATM-890 Series Acoustic Telemetry Modems should take into account the required modem operating depth and communications range, and the multipath and noise factors. As there are many possible deployment configurations that will take these factors into account, especially for the subsea modems, typical deployment configurations are presented only. In addition, refer to Section 4, "Setup and Test," for information on the cables and connectors used to connect the modems. The modems should be set up and tested prior to deployment.

Each subsea modem is encased within an anodized aluminum housing. Each remote transducer is encapsulated in a protective urethane mold and mounted to an anodized aluminum housing, which contains a built-in preamplifier and transmitter. These configurations provide a high degree of protection from physical damage. However, for all installation configurations, any installed cables that provide external power to the modem or connect to a remote transducer should be properly secured to prevent crimping or accidental disconnection.

Dunking Transducer Deployment

The AT-408 Omnidirectional Transducer or the AT-421 Directional Transducer can be used as a dunking transducer with the ATM-891 Deck Box. When a remote transducer is used as a dunking transducer, the 25-meter cable that is included with the deck box is used both to connect to the transducer and to lower it into the water. This cable must be strain relieved at the transducer end. Therefore, a Kellums grip is installed on the cable for this purpose. To strain relieve the cable, tie a nylon line from the loop in the Kellums grip to one of the holes in the connector guard. When securing the line, ensure that there is sufficient slack in the section of cable between the Kellums grip and the transducer connection to relieve any strain. In addition, when using a remote transducer as a dunking transducer, it may be required to add weight to the transducer to ensure it remains vertical in the water column.

Subsea Modem Deployment

Any of the subsea modems, namely, the ATM-885, the ATM-885R, the ATM-887, or the ATM-887R Acoustic Telemetry Modem, are typically moored on the sea floor, attached to a subsea structure, or installed on an AUV. In all cases the modem's built-in transducer or its remote transducer should be mounted such that it is oriented correctly. Refer to "Transducer Orientation" on page 3-7 for more specific requirements, and to Section 9, "Drawings," for detailed dimensional information on the subsea modems. When a subsea modem is moored, it should be securely anchored using a clump weight. And if it is moored or attached to a subsea structure, it should be pulled up vertically using flotation. The side bar that is attached to the modem housing is used both to attach the flotation and to anchor the modem to a clump weight or a structure.

Mounting Instruments to the ATM-888 Subsea Modem

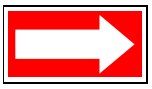
Small instruments can be mounted directly on the ATM-888 Acoustic Telemetry Modem. A typical configuration might be a cylindrical instrument mounted on the strongback opposite the modem housing. For example, stainless steel hose clamps or plastic tie wraps may be used to mount an instrument to the strongback using the existing slots provided for this purpose. Mounting holes may also be drilled into the middle part of the flanges of the strongback to facilitate bracket or strap mounting. Be sure to mount the instruments in a way that does not distort the shape of the PVC housing or dislodge it from the strongback.

WARNING Do not place stresses on the housing by fastening bands around it or by clamping anything directly to it. These stresses could distort the housing and cause a leak to occur. Similarly, do not attach hose clamps around both the housing and the strongback, as doing so also could cause a leak to occur.

4 Setup and Test

This section provides instructions on how to unpack, set up and test the ATM-880 and ATM-890 Series Acoustic Telemetry Modems. In addition, some simple startup procedures are provided that will help to quickly verify that the modems are operating properly and that commands and data are reliably transmitted and received. Specifically, the following topics are covered:

- ***Unpacking and inspection***
- ***Some typical modem configurations***
- ***Modem connections***
- ***Operator functions***
- ***Setting up and checking the modems***
- ***Verifying operation of the modems***



NOTE Once the modems are set up and are operating, refer to Section 5, "TelesonarPC," for instructions on how to easily configure and operate the modems using TelesonarPC. Also refer to Section 6, "Modem Operating Modes and Commands," for detailed information on the modem commands and how to enter them.

Unpacking and Inspection

The ATM-880 and ATM-890 Series Acoustic Telemetry Modems, their associated components, and this manual are carefully packed in sealed boxes. Every effort is made to pack the modems to protect them during shipment. However, carefully inspect the boxes for any signs of external damage and immediately report any damage to Benthos and to the freight carrier.

After inspecting the boxes, locate and remove the packing list, which is on the outside of one of the boxes. While referring to the packing list, carefully remove the contents of each of the boxes, checking the items against the packing list to verify that all the items on the list are included. Inspect the items for any physical damage that might have occurred during shipment. Immediately report any damage to Benthos and to the freight carrier.

Typical Setup Configurations

There are a number of different possible setup configurations for the ATM-880 and ATM-890 Series Acoustic Telemetry Modems. However, in most cases the modems connect to a host processor through an RS-232 or an RS-422 serial interface. The ATM-887 and ATM-887R Acoustic Telemetry Modems provide an RS-232 interface only. The host processor can be a PC, an embedded processor, an instrument, or any other device that can act as a data terminal.

In a typical setup there is always a *local modem*, which connects to a *local host processor,* and at least one *remote modem*, which connects to a *remote host processor*. This configuration is only a matter of reference; their roles can be reversed. Typically, however, the local modem is the modem to which commands and data are input over the serial interface from the local host processor, usually a PC. And the remote modem is the modem to which acoustic commands are transmitted and from which data and acknowledgments are received by the local modem over the acoustic link.

A typical configuration is shown in Figure 4-1. Here the local modem is the ATM-891 Deck Box, which is connected to a local host processor, a PC, through its RS-232 serial port. The remote modem is an ATM-885, which is connected to an instrument through its RS-232 serial port.

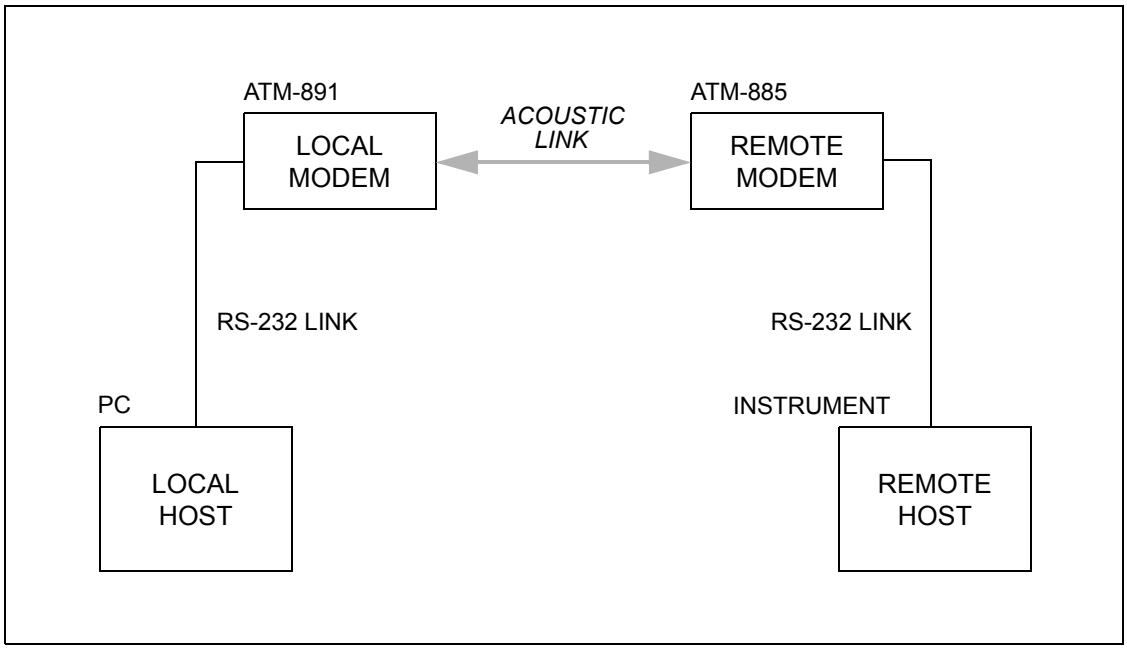


Figure 4-1 Setup with ATM-891 Deck Box as the Local Modem

In another typical configuration, the local modem is one of the subsea modems, which is connected to a host processor. An example of this is shown in Figure 4-2, where an ATM-885 is the local modem. In this setup the local modem communicates with three remote modems, which are also ATM-885 modems, and where each is connected to an instrument.

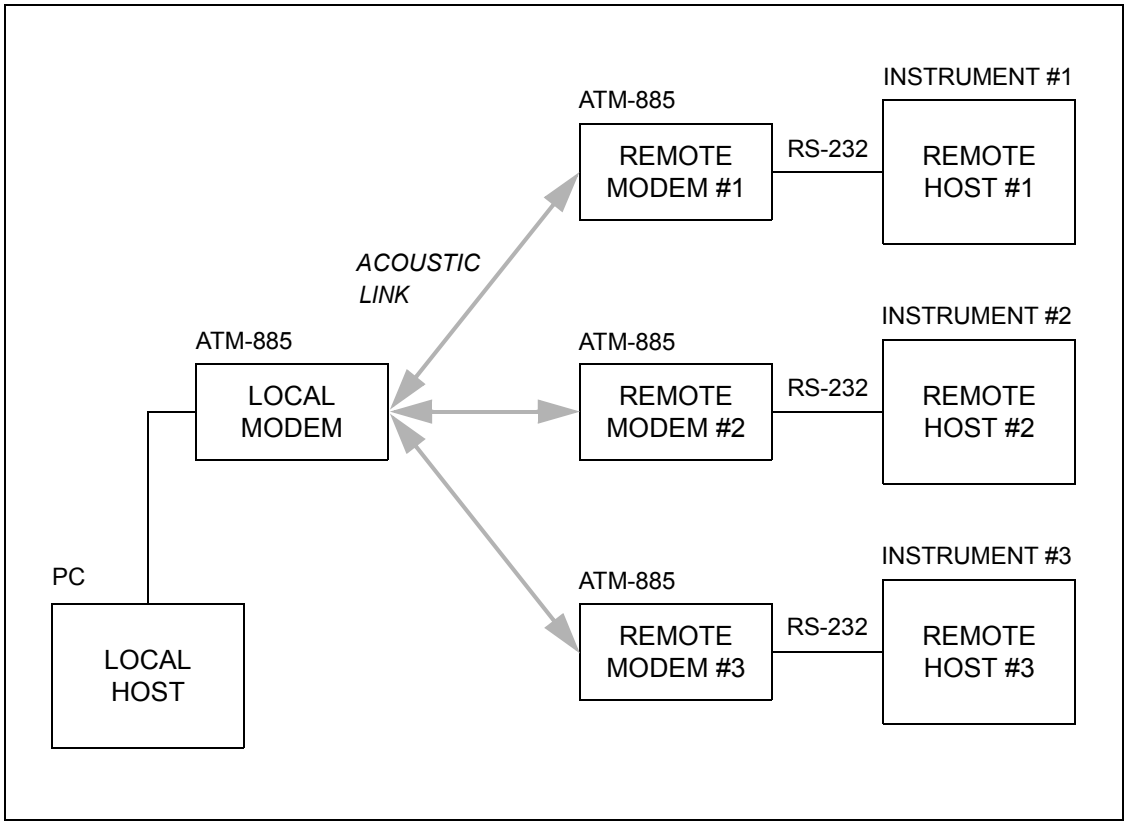


Figure 4-2 Setup with ATM-885 as Local and Remote Modems

Modem Connections

Although cables are supplied, special installations might require customer supplied cables and connectors. For this purpose complete connector and pinout descriptions are provided in the following pages.

ATM-891 Deck Box Front Panel Connectors

The ATM-891 Deck Box front panel connectors and their description and use are listed below and are shown in Figure 4-3.

Connector	Description and Use
AC POWER:	CEE-type AC input connector that connects to the AC power source.
DC POWER:	(2) banana jacks/binding posts, red (+) and black (-), that connect to the DC power supply (21–28 VDC)
SERIAL I/O:	DB-9S, RS-232/422 female serial port connector that connects to the host processor.
TRANSDUCER:	10-pin 97-3102A18-1S female connector that connects to the remote transducer.

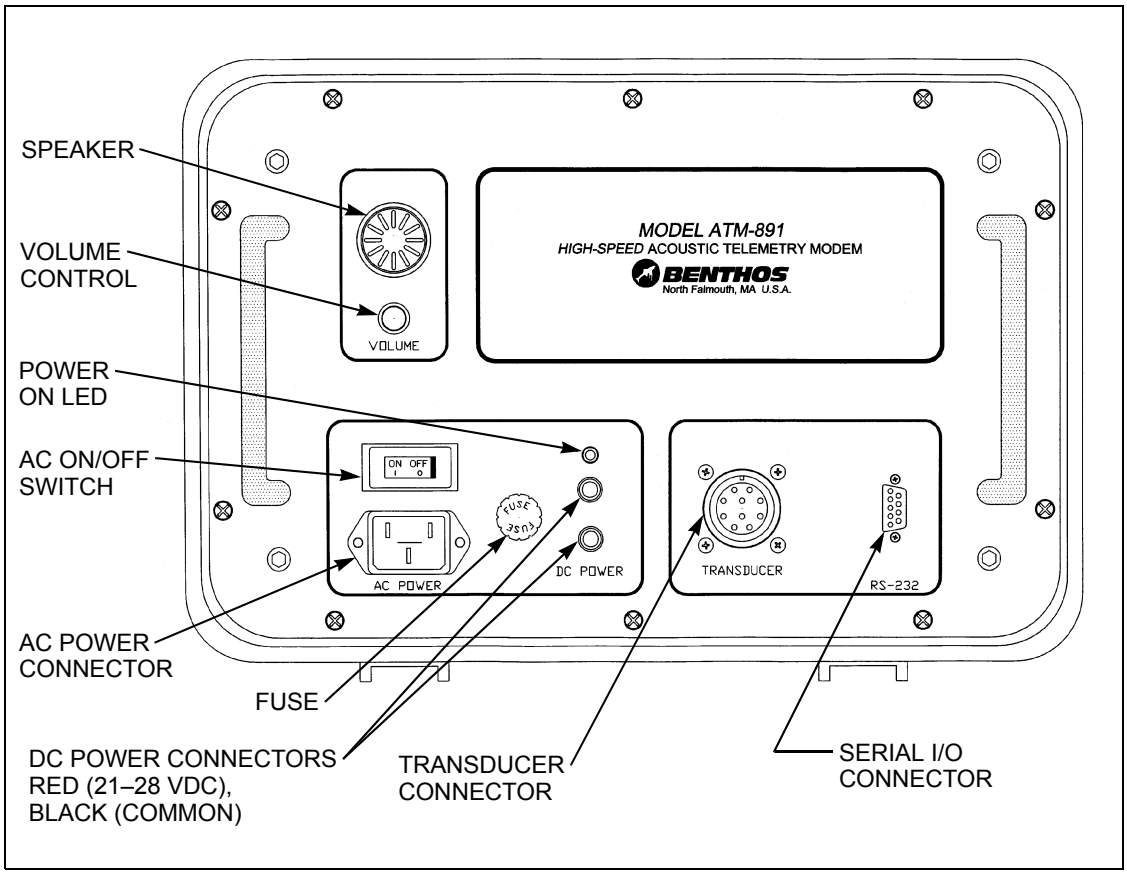


Figure 4-3 ATM-891 Deck Box Front Panel

Subsea Modem Connectors

All the subsea modems include a POWER/SERIAL connector on the bottom end cap for the external power and RS-232/422 connections. The ATM-885R and ATM-887R Acoustic Telemetry Modems also include a TRANSDUCER connector on the top end cap for connecting to a remote transducer. A 2-meter cable is supplied for this purpose.

Modem Operator Functions

All the modem functions are controlled directly from the host processor, including the keyboard of a PC if a PC is used as the host processor. However, a number of operator functions are provided on the front panel of the ATM-891. The subsea modems have only one operator function, an on/off switch that powers up and powers down the modem.

ATM-891 Deck Box Operator Functions

The ATM-891 Deck Box operator functions and their descriptions and use are listed below and are shown in Figure 4-3 on page 4-4.

Function	Description and Use
AC ON/OFF switch:	An AC circuit breaker/rocker switch that turns the deck box AC power on or off.
POWER ON LED:	A red indicator that is illuminated when power is applied.
SPEAKER:	Provides an audio verification of transmitted and received data.
VOLUME control:	A single turn potentiometer that controls the volume level of the speaker.
FUSE:	A 4-amp slo-blow fuse that protects both the internal and, if used, the external DC power supply.

Subsea Modem Operator Functions

The only operator function on the subsea modems is the on/off switch, which is located on the side of the end cap as shown in Figure 4-4 for the ATM-885 and ATM-885R Acoustic Telemetry Modems. A similar configuration is provided for the ATM-887 and ATM-887R Acoustic Telemetry Modems. To turn on the subsea modem, push the switch all the way in. To turn off the modem, pull the switch all the way out. This configuration causes the modem to turn on automatically when deployed due to ambient pressure.

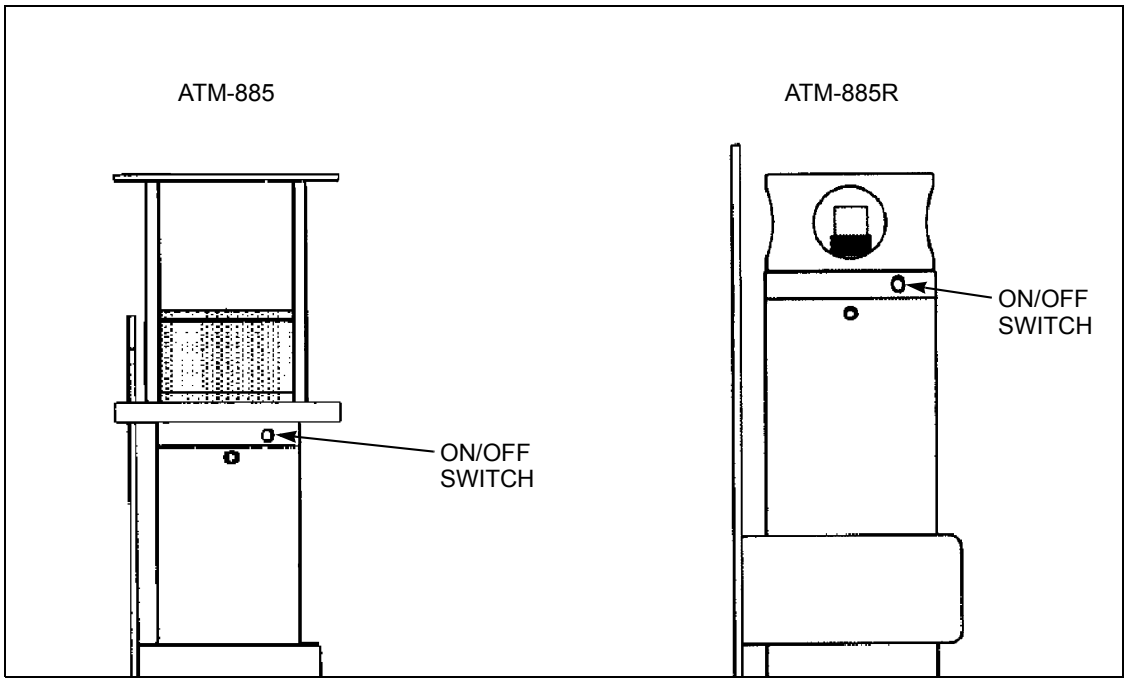


Figure 4-4 Subsea Modem On/Off Switches

NOTE The ATM-888 Acoustic Telemetry Modem does not include an on/off switch. The ATM-888 is powered when DC power is connected to the POWER/SERIAL connector.

Setting Up the Modems

To check and operate the modems, they must be connected to their host processors and transducers. A host processor can be either a PC or an instrument. The information presented in the following pages encompasses connecting the modems to PCs so that their operation can be verified and the acoustic link can be checked in air. If an instrument is to be used as a host processor, refer also to the documentation provided with the instrument.

Setting up the ATM-891 Deck Box

Setting up the ATM-891 Deck Box requires making the power and serial interface connections and connecting a remote transducer as a dunking transducer. When connecting the deck box to a PC, refer to Figure 4-5 for the SERIAL I/O connector pin orientation and to Table 4-1 for the pinout information.

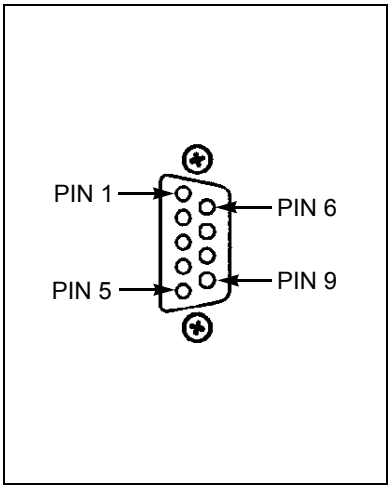


Figure 4-5 ATM-891 SERIAL I/O Connector

Table 4-1 ATM-891 SERIAL I/O Connector Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
3	RXD	RS-232 Receive	Host to Modem
2	TXD/RX(-)	RS-232 Transmit/RS-422 Receive(-)	Modem to Host/ Host to Modem
8	RTS/RX(+)	Request to Send/RS-422 Receive(+)	Modem to Host/ Host to Modem
5	GND	Common Ground	
6	TX(-)	RS-422 Transmit(-)	Modem to Host
4	TX(+)	RS-422 Transmit(+)	Modem to Host
9	+12 VDC	DC Power for host processor	Modem to Host

Perform the steps listed below to connect a remote transducer and a PC to an ATM-891 Deck Box. Refer to "ATM-891 Deck Box Front Panel Connectors" on page 4-4 for information on the deck box connectors and their locations.

1. Connect the supplied 25-meter transducer cable from the TRANSDUCER connector on the deck box to the bulkhead connector on the remote transducer that is to be used as the dunking transducer.
2. If AC power is to be used, connect the supplied AC power cable to the AC POWER connector on the deck box.

   If DC power is to be used, connect the supplied DC power cable to the banana jack/binding posts, connecting 21–28 VDC to red and common to black.
3. Connect an RS-232 serial cable from the SERIAL I/O connector on the deck box to an available serial COM port on the PC. Refer to Table 4-1 on page 4-7 for the connector pinout information. A straight wire, pin for pin connection to the PC's serial COM port is what is required.

Table 4-2 ATM-891 SERIAL I/O Connector to DB-9 Pin-to-Pin Connections

ATM-891 I/O CONNECTOR			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	**LABEL**	**FUNCTION**		**PIN**	**LABEL**	**FUNCTION**
3	RXD	Receive	Host to Modem	3	TXD	Transmit
2	TXD	Transmit	Modem to Host	2	RXD	Receive
8	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send
5	GND	Ground	—	5	GND	Ground

Setting up the Subsea Modems

Setting up any of the subsea modems requires making the power and serial interface connections, and for an ATM-885R or ATM-887R Acoustic Telemetry Modem, the transducer connections.

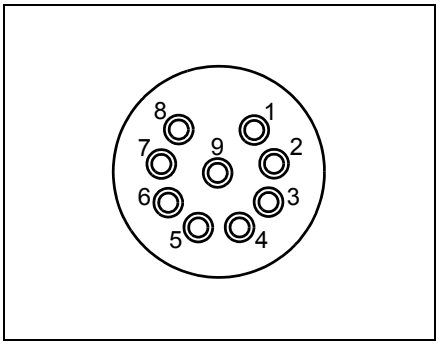


Figure 4-6 Subsea Modem POWER/SERIAL Connector

Power and Serial Interface Connections. The power and serial interface connections are made with the POWER/SERIAL connector located on the bottom end cap of the subsea modem. Either an RS-232 or an RS-422 serial interface connection can be made. When connecting the subsea modem to a PC or to an instrument, refer to Figure 4-6 for the POWER/SERIAL connector pin orientation, and to Table 4-3 for the pinout information. The POWER/SERIAL connector is a 9-pin Impulse MBH-9-MP bulkhead connector that requires an Impulse MIL-9-FS mating connector pigtail.

Table 4-3 Subsea Modem POWER/SERIAL Connector Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
1	Power	External Power Input (21–28 VDC)	To Modem
2	—	Reserved	—
3	GND	Common Ground	
4	TX(+)	RS-422 Transmit(+)	Modem to Host
5	DE	Device Enable (See NOTE below.)	Modem to Host
6	RTS/RX(+)	Request to Send/RS-422 Receive(+)	Modem to Host/ Host to Modem
7	TX(-)	RS-422 Transmit(-)	Modem to Host
8	RXD	RS-232 Receive	Host to Modem
9	TXD/RX(-)	RS-232 Transmit/RS-422 Receive(-)	Modem to Host/ Host to Modem

NOTE The Device Enable output is on when the modem is sending data to the host or if the modem receives the Dial command (ATD). Refer to "Device Enable" on page 6-3 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.

NOTE When the modem is switched on, the internal batteries automatically power the modem when there is no external power or if the external power drops below 22 VDC.

To connect the modem to a power supply, and to an instrument using the RS-232 or RS-422 interface, refer to the pinout information provided in Table 4-3 on page 4-9 for the POWER/SERIAL connector, and to the connector information provided with the instrument. A mating connector pigtail is provided for this purpose.

To connect a subsea modem to a power supply and to a PC, perform the steps listed below.

1. Connect the connector pigtail to the POWER/SERIAL connector.
2. Refer to Table 4-4 and connect the pins listed to an available serial COM port on the PC. The table shows the connections for a DB-9 serial port connector typically used on laptop computers.
3. Refer to Table 4-3 and connect the DC power and ground pins to the DC power supply if one is used.

Table 4-4 Subsea Modem POWER/SERIAL Connector to DB-9 Pin-to-Pin Connections

SUBSEA MODEM POWER/SERIAL CONNECTOR			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	**LABEL**	**FUNCTION**		**PIN**	**LABEL**	**FUNCTION**
3	GND	Common Ground		5	GND	Ground
6	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send
8	RXD	Receive	Host to Modem	3	TXD	Transmit
9	TXD	Transmit	Modem to Host	2	RXD	Receive

Transducer Connections. For an ATM-885R or ATM-887R Acoustic Telemetry Modem, connect the transducer cable, purchased separately, to the TRANSDUCER connector on the modem and to the bulkhead connector on the remote transducer.

Setting up the Modem Board Sets

The ATM-885PCB and ATM-885RPCB Board Sets are set up with all the connections made directly to the boards.

Power and Serial Interface Connections. The power and serial interface connections, RS-232 or RS-422, are made with separate connectors on both the ATM-885PCB and ATM-885RPCB Board Sets. When connecting an ATM-885PCB or an ATM-885RPCB to a PC or to an instrument, power is connected to J3 of the Power Supply/Filter Board, and the serial interface connection is made to J4 of the DSP Board. Refer to Figure 4-7 for the DSP Board serial connector J4 pin orientation, and to Table 4-5 for the pinout information. Refer to Table 4-6 for the power connector J3 pinouts. The locations of the connectors are shown in Drawings B875-08659 and B875-08693. The drawings are included in Section 9, "Drawings."

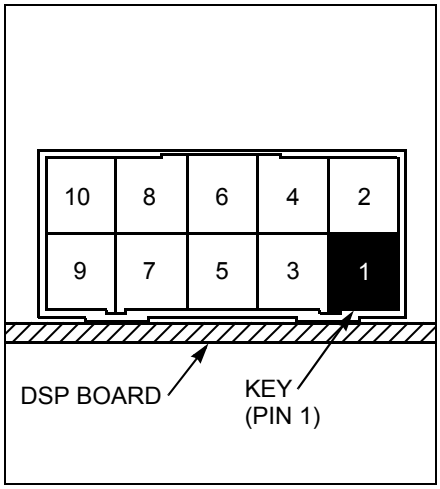


Figure 4-7 ATM-885PCB and ATM-885RPCB DSP Board Serial Connector J4

Table 4-5 ATM-885PCB and ATM-885RPCB DSP Board Serial Connector J4 Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
2	No Connection		
4	TXD/RX(-)	RS-232 Transmit/RS-422 Receive(-)	Modem to Host/ Host to Modem
6	RXD	RS-232 Receive	Host to Modem
8	No Connection		
10	RTS/RX(+)	Request to Send/RS-422 Receive(+)	Modem to Host/ Host to Modem
1	Keyed Pin		
3	GND	Common Ground	
5	TX(+)	RS-422 Transmit(+)	Modem to Host
7	DE	Device Enable (See NOTE below.)	Modem to Host
9	TX(-)	RS-422 Transmit(-)	Modem to Host

NOTE The Device Enable output is on when the modem is sending data to the host or if the modem receives the Dial command (ATD). Refer to "Device Enable" on page 6-3 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.

Table 4-6 ATM-885PCB and ATM-885RPCB Power Supply/Filter Board Power Connector J3 Pinouts

PIN	FUNCTION
1	Reserved
2	Ground
3	External Power Input 1 (21–28 VDC)
4	Ground
5	External Power Input 2 (21–28 VDC)

Perform the steps listed below to connect an ATM-885PCB or ATM-885RPCB to a DC power supply and to an instrument or PC.

WARNING Pin 5 is NOT protected against reverse polarity. DO NOT connect Pin 5 to the negative of the DC power supply as damage to the modem will occur. If reverse polarity protection is required, connect Pin 3 to the DC power supply positive instead as described below for Step 4.

1. Refer to Table 4-6 and connect Pin 5 to the DC power supply positive through a 6-Amp inline fuse.
2. Connect Pin 4 to the DC power supply negative.
3. If connecting the ATM-885PCB or ATM-885RPCB to an instrument, refer to Table 4-5 on page 4-11 and connect the pins listed to the RS-232 or RS-422 interface of the instrument.

   If connecting the ATM-885PCB or ATM-885RPCB to a PC, refer to Table 4-7 and connect the pins listed to an available serial COM port on the PC.

If required, continue with the steps listed below to connect a second DC power supply as a backup or if reverse polarity protection is required when connecting a single supply.

NOTE Pin 3 is diode protected against reverse polarity. Connect Pin 3 to the DC power supply positive when reverse polarity protection is required. Some power loss will result due to the power dissipation across the diode.

4. Refer to Table 4-6 and connect Pin 3 to the DC power supply positive through a 6-Amp inline fuse
5. Connect Pin 2 to the DC power supply negative.

Table 4-7 ATM-885PCB and ATM-885RPCB DSP Board Serial Connector J4 to DB-9 Pin-to-Pin Connections

ATM-885PCB and ATM-885RPCB DSP BOARD SERIAL CONNECTOR J4			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	LABEL	FUNCTION		PIN	LABEL	FUNCTION
4	TXD	Transmit	Modem to Host	2	RXD	Receive
6	RXD	Receive	Host to Modem	3	TXD	Transmit
10	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send
3	GND	Common Ground		5	GND	Ground

ATM-885PCB Transducer Connections. The ATM-885PCB includes an omnidirectional or directional transducer and a transducer cable. Connect the transducer cable to the transducer and to J2 of the Transmitter Board. Table 4-8 shows the pinout information for the connectors on the transducer cable. A wiring diagram for the transducer cable is shown in Figure 4-8. The transducer cable transducer connector is an Impulse RMG-3-FS connector.

Table 4-8 ATM-885PCB Transducer Cable Wiring

TRANSMITTER BOARD J2	FUNCTION	TRANSDUCER CABLE TRANSDUCER CONNECTOR
1	Transducer (+)	**3**
2	—	**No Connection**
3	Transducer (-)	**2**
4	Shield	**1**

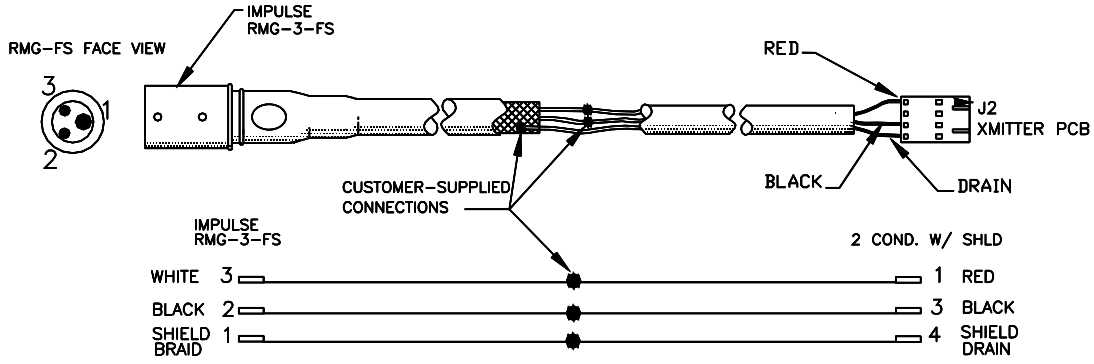


Figure 4-8 ATM-885PCB Transducer Cable Wiring Diagram

ATM-885RPCB Transducer Connections. The ATM-885RPCB connects to any of the remote transducers. A bulkhead connector wiring assembly is supplied for connecting to the ATM-885RPCB. The bulkhead connector is a Subcon MCBH8F, which connects to the transducer cable supplied with the remote transducer. Refer to Table 4-9 and connect the bulkhead connector wiring assembly to J7 on the Interface Board and to J1 on the Power Supply/ Filter Board. Connect the remote transducer cable to the bulkhead connector wiring assembly and to the bulkhead connector on the remote transducer.

Table 4-9 ATM-885RPCB Bulkhead Connector Wiring

INTERFACE BOARD J7	POWER SUPPLY/FILTER BOARD J1	FUNCTION	BULKHEAD CONNECTOR WIRING ASSEMBLY
PIN	PIN		
1	—	Transmit Power (+)	8
2		Transmit Power (-)	7
3		Transmit On/Off	6
4		Transmit Signal	5
5		Power Control	4
6		Analog Ground	3
—	Shield	—	2
	Conductor		1

Setting up the ATM-880 Module

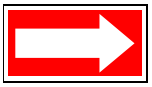
Setting up the ATM-880 Module requires the same power, serial interface and transducer connections as the subsea modems. Refer to "Setting up the Subsea Modems" on page 4-9 for instructions. The POWER/SERIAL connector is located on the side of the ATM-880 Module.

Setting up the Host Processor

If a PC is to be used as the host processor, it must be set up to run a terminal program, such as ProComm Plus, which is available from DataStorm Technologies; or Hyperterminal, which is provided with the Windows operating system; or DumbTerm, which is available from RDI Instruments. The serial port used to connect to the modem must be selected and correctly configured using the terminal program.

If an instrument is to be used as the host processor, refer to the documentation provided with the instrument for the setup information.

For a convenient, user friendly means of configuring and operating the modems without using a terminal program, TelesonarPC can be used. For instructions on how to install and start TelesonarPC, refer to "Installing and Starting TelesonarPC" on page 5-1.



NOTE If TelesonarPC is installed and will be used to operate the modem, it is not necessary to set up the PC as instructed below. Instead, refer to "Selecting and Configuring the Local Modem's Serial Communications Port" on page 5-15 to select the COM port, the baud rate, the serial interface, and the handshaking to be used by the modem.

After connecting the modem to the PC as described in "Setting Up the Modems" on page 4-7, perform the steps listed below to prepare the PC.

1. Install the terminal program communications software on the PC.
2. Start the terminal program, select the serial port that is connected to the modem, and configure the port as follows:

Baud Rate:	**9600 bits/sec**
Parity:	**None**
Data Bits:	**8**
Stop Bits:	**1**

Checking the Modems and Host Processors

Once the modems and host processors are set up, some simple preliminary checks can be made to verify that the modems are operating properly and that all of the connections are correct.

Verifying Operation of the ATM-891 Deck Box

If an ATM-891 Deck Box is set up, perform the steps listed below to check its operation.

1. Connect the AC power cable to an available 100–120 VAC, 50–60 Hz or 200–240 VAC, 50–60 Hz power source, or the DC power cable to a 21–28 VDC power supply.
2. Switch the AC ON/OFF switch on the front panel of the deck box to ON, or switch on the DC power supply.
3. Rub the remote transducer head to check the connection between the transducer and the modem. When rubbing the transducer, sounds should be heard coming from the speaker on the front panel of the deck box. If the sounds cannot be heard, increase the speaker volume by adjusting the VOLUME control.
4. Switch the AC ON/OFF switch on the front panel of the deck box to OFF, or switch off the DC power supply.

Verifying a Modem's Operating Parameters

When a modem is powered up, it will initialize a number of modem operating parameters, such as the serial interface and transmitting acoustic baud rates, the modem address, and other parameters. These operating parameters are stored in S Registers, and they can be changed from the host processor by using modem commands. A changed S Register setting can also be made the new default setting, which is its setting when the modem is powered up. Detailed information on how to enter modem commands is presented in Section 6, "Modem Operating Modes and Commands," and detailed information on the S Registers and how to set them is presented in Section 7, "Modem Operating Parameters (S Registers)."

Perform the steps listed below to verify that the host processor is communicating properly with the modem and the S Registers are initialized.

1. Turn on the PC and run the terminal program.
2. If the ATM-891 Deck Box is being used as the modem, switch the AC ON/OFF switch on the front panel to ON, or switch on the DC power supply. If a subsea modem is being used as the modem, switch on the modem by pushing in the switch on the side of the end cap.

   The banner message followed by the command prompt (>) is displayed. The message includes the frequency band (LF, MF, HF, or Nonstandard) the firmware version, and the command prompt as shown in the following example for an ATM-891 Deck Box:

   Benthos ATM-89X
   MF Frequency Band
   Acoustic Modem Version 5.0
   >

   Similarly, for the ATM-880 Module and all the subsea modems, the banner message is as in the following example:

   Benthos ATM-88X
   MF Frequency Band
   Acoustic Modem Version 5.0
   >

3. At the command prompt type ATS?, and then press Enter.

   The S Register settings of the modem are displayed as in the following example:

   Local Registers

   S00=042 S01=001 S02=000 S03=001 S04=005 S05=000 S06=008

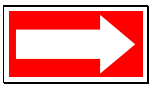
   S07=015 S08=060 S09=000 S10=255 S11=001 S12=000 S13=002

   S14=001 S15=000 S16=000 S17=001 S18=000 S19=000 S20=000

   >

Setting a Modem's Operating Parameters

The S Register settings of the modem can be set whenever the modem is in Command mode, the mode in which the command prompt (>) is displayed. If the modem is not in Command mode, type +++ in rapid succession. The command prompt will be displayed. The Set Register Command (ATSn=n) is used to set an S Register setting, where the first n in the command is the S Register number and the n following the equal character (=) is the desired setting. The Write command (AT&W) can be used to save the S Register settings as the new startup configuration, where the changed settings become the new default settings, which are the settings when the modem is powered up.



NOTE Refer to Section 6, "Modem Operating Modes and Commands," for detailed information on the modem commands and how enter them.

Perform the steps listed below to verify that the S Registers can be set by setting S Register 4 to 07 and making it the default setting for the startup configuration.

1. At the command prompt (>) type ATS4=07, and then press Enter. The command is executed, the modem responds with the message "OK," and the command prompt is again displayed:

   ATS4=07
   >01200 bits/sec
   OK
   >

   This sets the transmitting acoustic baud rate of the modem to 1200 baud.

2. Type AT&W, and then press Enter. The command is executed and the command prompt is once again displayed:

   AT&W
   Sregisters Stored
   >

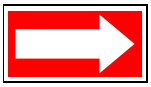
   The setting of S Register 4 is now the default setting. Therefore, whenever the modem is powered up, the S4 setting will be 07.

Checking the Acoustic Link between Two Modems in Air

To check the acoustic link between two modems in air, both modems must be set up with at least one modem connected to a host processor.

Perform the steps listed below to test the acoustic link between two modems.

1. Place the modems or the modem's remote transducers within a foot of each other. Be sure no obstacles are between them.
2. Turn on the PC and run the terminal program.



NOTE If the modems are being checked for the first time, their addresses are both 00. Both modems can have the same address for this test.

3. If the ATM-891 is being used as a modem, switch the AC ON/OFF switch on the front panel to ON, or switch on the DC power supply. If a subsea modem is being used as a modem, switch on the modem by pushing in the switch on the side of the end cap.

   The banner message followed by the command prompt (>) is displayed. The message includes the frequency band (LF, MF, HF, or Nonstandard) the firmware version, and the command prompt as shown in the following example for an ATM-891 Deck Box:

   Benthos ATM-89X
   MF Frequency Band
   Acoustic Modem Version 5.0
   >

   Similarly, for the ATM-880 Module and all the subsea modems, the banner message is as in the following example:

   Benthos ATM-88X
   MF Frequency Band
   Acoustic Modem Version 5.0
   >

4. Type AT, and then press Enter.

   The message "OK" and the command prompt are displayed.

NOTE When checking the acoustic link in air, should the link appear not to be working, vary the separation of the transducers. In addition, it may be required to change the transmit power level of the local modem, usually to a lower level. The transmit power level is set by using the Set Register command (ATSn=n) to change the setting of S Register 6. For instructions on how to use the Set Register command, refer to "Set Register ATSn=n" on page 6-39. Refer also to "Transmit Power Level S6" on page 7-15 for information on the available transmit power level settings.

5. Enter the Acoustic Link Test command (ATXn), where n is the address of the modem that will receive the command, and then press Enter.

   The modem transmits a preset test message over the acoustic link, and the following information, which is the received data statistics about the received message, is displayed:

ERR:	Number of bits not matching the test message.
CRC:	Checksum.
MPD:	Multipath delay.
SNR:	Signal-to-noise ratio.
SPD:	Relative speed between the modems.
AGC:	Automatic gain control output.
CCERR:	Number of corrected errors.

   Refer to "Acoustic Link Test ATXn" on page 6-27 for more information on the Acoustic Link Test command and the received data statistics.

6. Type AT$Sn, where n is the address of the modem that will receive the command, and then press Enter.

   The modem transmits its S Register settings over the acoustic link, and they are displayed as in the following example:

   Remote Registers

   S00=041 S01=001 S02=000 S03=002 S04=005 S05=000 S06=008

   S07=015 S08=060 S09=000 S10=255 S11=000 S12=000 S13=003

   S14=000 S15=000 S16=000 S17=001 S18=001 S19=000 S20=000

   >

5 TelesonarPC

TelesonarPC, which runs on the Microsoft Windows 98/2000/NT/XP operating system, is a graphical users interface (GUI) software program that provides a user friendly means of configuring and operating the ATM-880 and ATM-890 Series Acoustic Telemetry Modems, including the SMART Release, without having to enter specific commands.

NOTE When using TelesonarPC, any reference to a local modem refers to the modem to which commands and data are input from the PC over the serial interface. Any reference to a remote modem refers to the modem to which acoustic commands are sent and from which data and acknowledgments are received over the acoustic link.

This section provides instructions on how to install and start TelesonarPC and describes its many features and how to use them.

Installing and Starting TelesonarPC

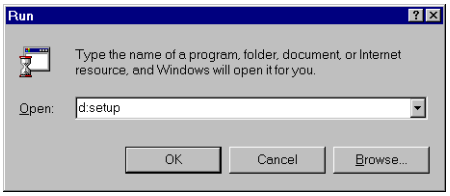
TelesonarPC is installed using the TelesonarPC Setup program, which is started by choosing Run in the Start menu. After installation, TelesonarPC can be started. Instructions on how to install, start, check the version number, exit from, and uninstall TelesonarPC are provided below.

Installing TelesonarPC

To install TelesonarPC:

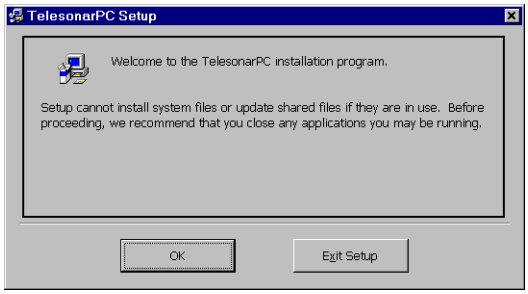
1. Exit all programs and turn off any virus protection or screen saver software.
2. Insert the TelesonarPC for Windows CD into the CD-ROM drive.
3. Select Start ➤ Run.

   The Run dialog box opens:



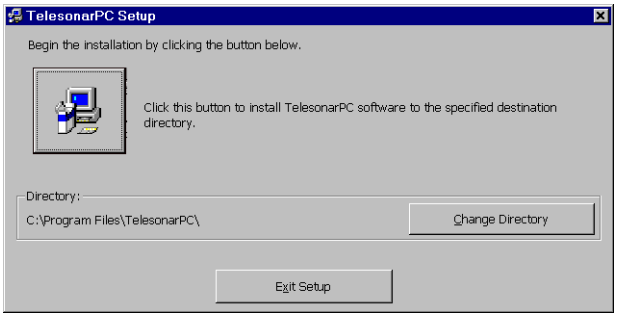
4. Enter d:setup in the Open text box, where "d" is the drive letter of the CD-ROM drive, and then click OK.

   The first TelesonarPC Setup dialog box opens:



5. Click OK.

   The second TelesonarPC Setup dialog box opens:



6. Click the Install button ( ) to install TelesonarPC in the specified destination directory. Or instead, click Change Directory and follow the instructions to select a different directory, and then click the Install button.

7. Click Continue in the Choose Program Group dialog box that opens.

   TelesonarPC is installed and ready to be started.

Starting TelesonarPC

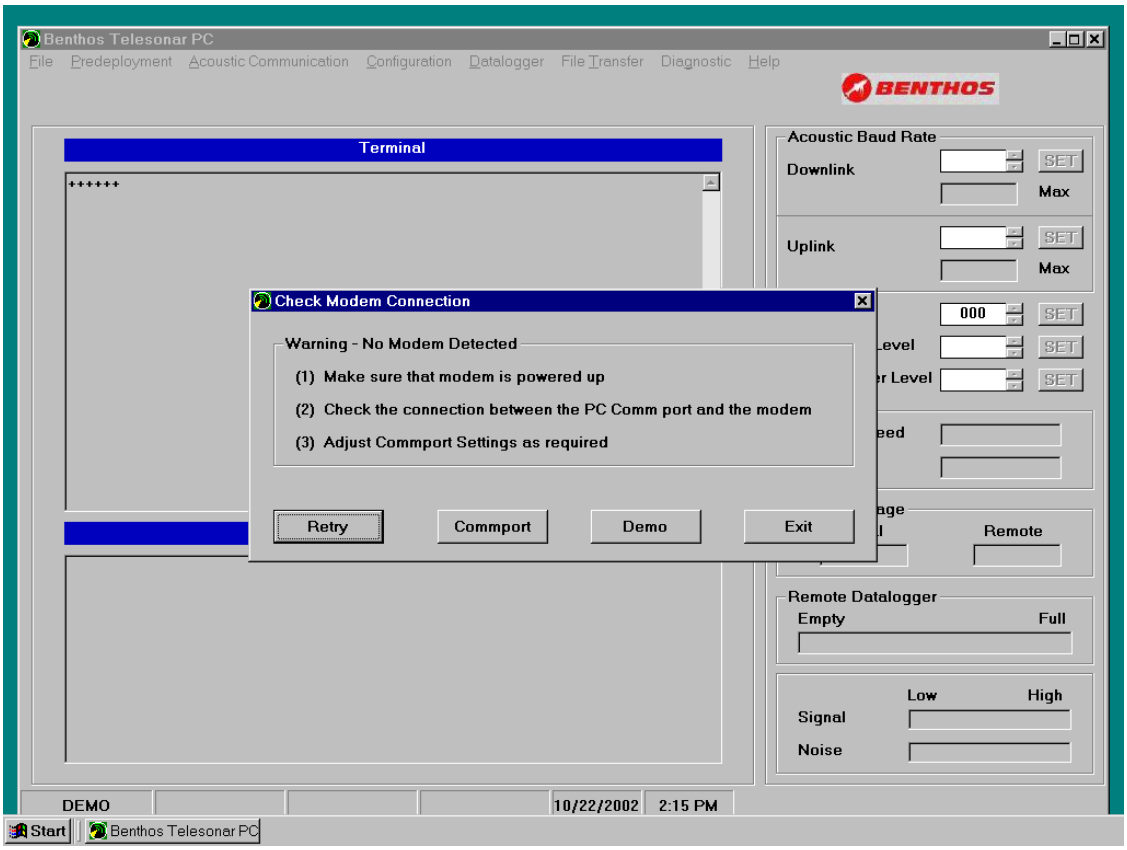
To start TelesonarPC:

1. Select Start ➤ Programs ➤ TelesonarPC.

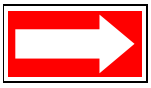
   The TelesonarPC applications menu opens:

2. Choose TelesonarPC.

TelesonarPC starts and the Main window opens as it appears when no modem is connected to the PC:



TelesonarPC can also be started by clicking the TelesonarPC icon ( ) on the Windows desktop.



NOTE If a modem has been connected to the PC as described in "Setting Up the Modems" on page 4-7 and the Check Modem Connection dialog box still appears as shown above, the serial communications port may not be configured correctly. To configure the port, Click Commport, select the correct baud rate and COM port in the PC Communications dialog box that opens, and then click SET to save the new selections.

When the Main window opens, and if a modem is connected to the PC and the correct baud rate and COM port are set, the modem has automatically gone online with the remote modem whose address is displayed in the Remote ID Status display of the Main window. However, if there is no remote

modem, or if the address of the remote modem is incorrect or not known, the Remote Modem window shown in Figure 5-1 also opens.

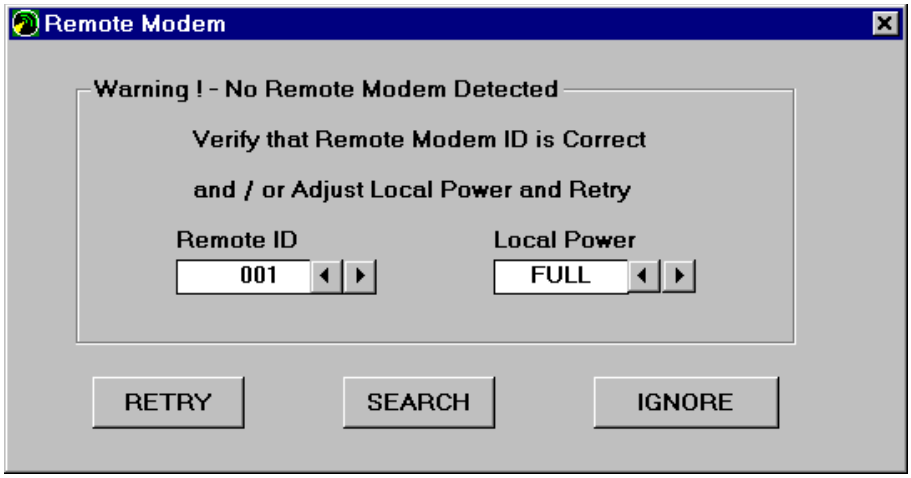


Figure 5-1 The Remote Modem Window

In the Remote Modem window, verify the address of the remote modem. If the address is wrong, select the correct address using the left or right arrow in the Remote ID scroll box, and then click RETRY. If the address is correct, try changing the transmit power level using the left or right arrow in the Local Power scroll box, and then click RETRY.

If the address of the remote modem is not known, click SEARCH to have TelesonarPC find a remote modem.

If there is no remote modem, the Main window can be accessed and the Remote Modem dialog box closed by clicking IGNORE. However, some of the items on the Menu bar will be dimmed and therefore unavailable.

Checking the TelesonarPC Version Number

To check the TelesonarPC version number, choose Help ➤ About. The About TelesonarPC window opens with the version number displayed.

Exiting TelesonarPC

To exit TelesonarPC:

1. Select File from the Menu bar in the Main window.

   The File menu opens.

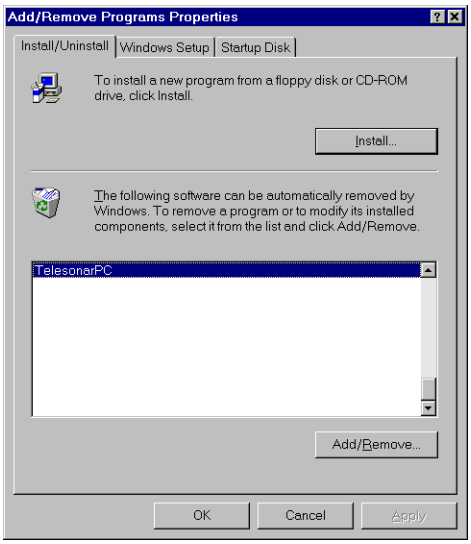
2. Choose Exit.

Uninstalling TelesonarPC

To uninstall TelesonarPC:

1. Exit from TelesonarPC.
2. Select Start ➤ Settings ➤ Control Panel to open the Control Panel.
3. Choose Add/Remove Programs in the Control Panel.

   The Add/Remove Programs Properties dialog box opens:



4. Select TelesonarPC, and then Click Add/Remove.
5. Click Yes when asked to confirm the removal of the program and all of its components.

   TelesonarPC is uninstalled.

The Main Window

The Main window, which opens when TelesonarPC is started, is shown in Figure 5-2 as it appears when a modem, the local modem, is connected to the PC and is online with a remote modem. Access to all of the commands for the local modem and all of the remote modems is available from the Main window. In addition, the Main window includes Status displays, a Status bar, Terminal and Input displays, and standard Windows features, such as the Menu bar, the Title bar, and the Maximize, Minimize, and Close buttons.

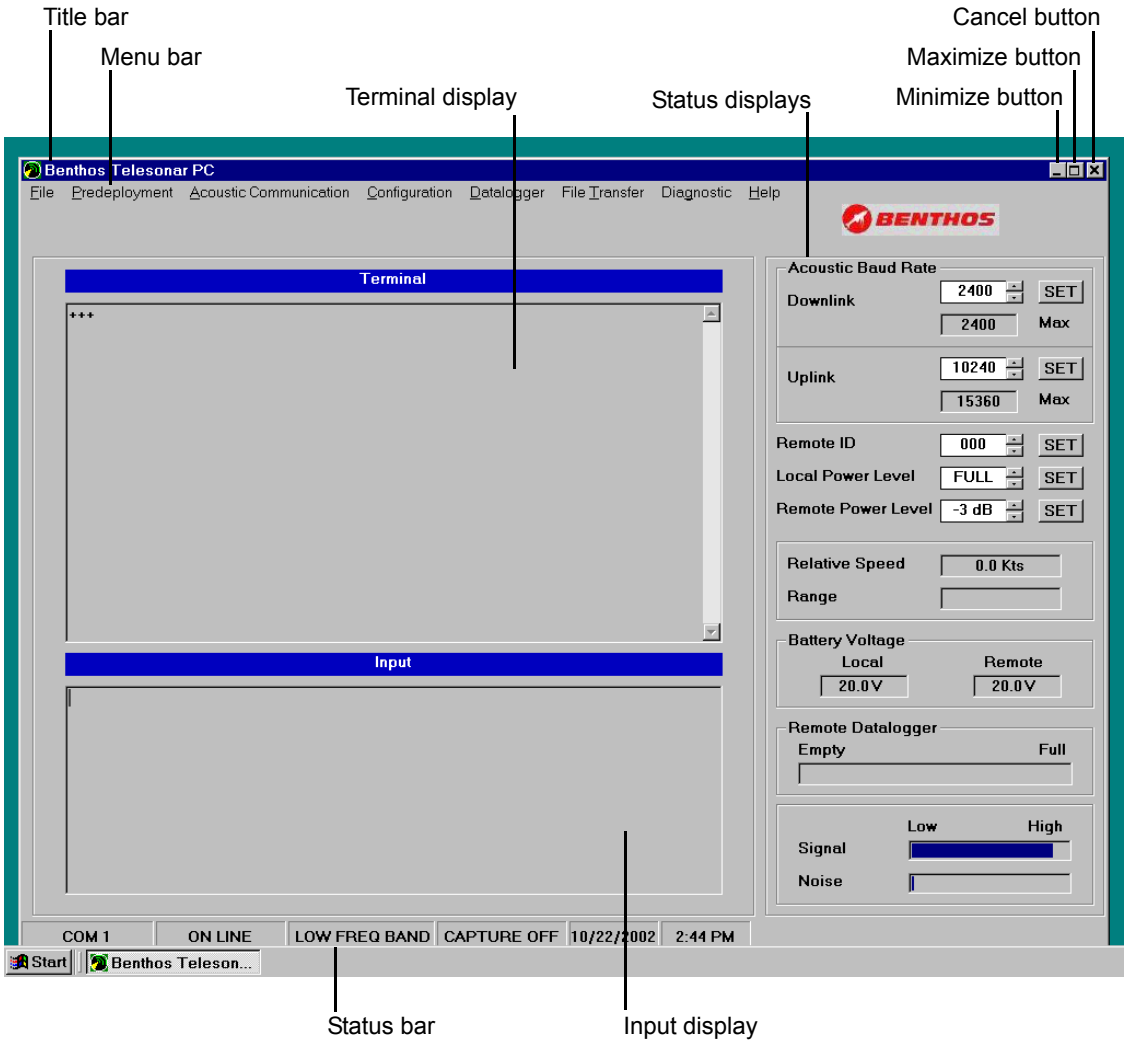


Figure 5-2 The Main Window

Menu Bar

The Menu bar provides access to all of the modem commands through pull-down menus. To open a menu from the Menu bar, place the mouse pointer on the menu name to select it, and then click the left mouse button. The menu opens as shown in Figure 5-3, which shows the opened Datalogger menu. To choose an item from an open menu, place the mouse pointer on the item to select it and then click the left mouse button. Although most of the items in a menu are commands or options, some may be the names of submenus, in which case a triangle (▶) follows the item. Selecting the item opens the submenu.

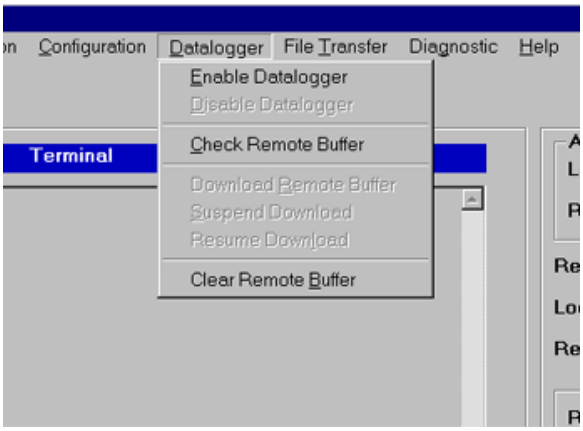


Figure 5-3 The Opened Datalogger Menu

Some menu items, when chosen, open a window or a dialog box, which may include many of the standard Windows features: check boxes, option buttons, drop-down list boxes, command buttons, and text boxes. Some menu items are options that can be enabled or disabled. When enabled, a check mark (✔) precedes Enabled; when disabled, the check mark precedes Disabled. To enable the function, place the mouse pointer on Enable and click the left mouse button; to disable the function, do the same for Disable. Some menu items may be dimmed, such as the Disable Datalogger command and several others in the Datalogger menu shown in Figure 5-3. This signifies the item cannot be chosen at the current time. When the item is available, it is displayed normally.

NOTE To close a menu without choosing a menu item, click anywhere outside the menu.

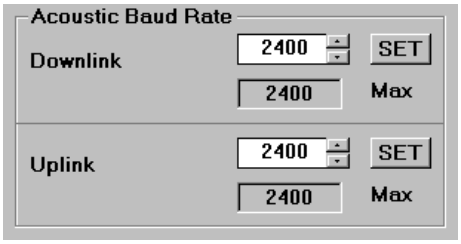
Status Bar

The Status bar is located at the bottom of the Main window as shown in Figure 5-2 on page 5-6. The Status bar provides information about the local modem, including the COM port of the PC that it is connected to, whether the modem is initializing, is online with another modem, is waiting for a response, or is in some other operating state. The Status bar also indicates the frequency band selected for the modem, whether Capture is on or off, and the current time and date.

For information on Capture, refer to "Capturing Received Data from the Remote Modem" on page 5-38.

Status Displays

The Status displays provide information about the local and remote modems. Some of the Status displays, such as the Acoustic Baud Rate, the Remote ID, and the Power Level Status displays can also be used to send commands to the local modem and to the remote modem that is online with the local modem. The Status displays are shown in the Main window in Figure 5-2 on page 5-6 and are described below.



Acoustic Baud Rate. Displays and selects the downlink acoustic transmit baud rate in bits/second of the local modem and the uplink acoustic transmit baud rate of the online remote modem.

To select the baud rate for either modem, click the up or down arrow in the corresponding drop-down list box until the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new baud rate is set, the display turns back to black.

Remote ID. Displays and selects the address of the remote modem to which commands and data can be sent. Any address from 000 to 099 can be selected.

To select the address, click the up or down arrow in the scroll box until the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new address is set, the display turns back to black.

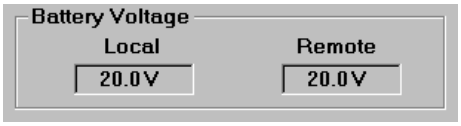
Local and Remote Power Levels. Displays and selects the transmit power level in decibels of the local modem and the online remote modem.

To select the power level for either modem, click the up or down arrow in the

corresponding drop-down list box until the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new power level is set, the display turns back to black.

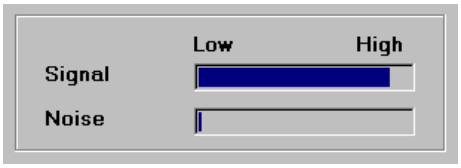
Relative Speed. Displays the relative speed in knots between the local and remote modems. To select the units of relative speed, select Configuration from the Menu bar, and then choose Speed Units. A positive number indicates the modems are moving closer together; a negative number indicates the modems are moving farther apart.

Range. Displays the range between the local and the online remote modem's transducers. To select the units of range and the sound velocity used in the calculation of range, select Configuration from the Menu bar, and then choose Range Options. To display the range, select Acoustic Communication from the Menu bar, and then choose Get Range.



Battery Voltage. Displays the local and the online remote modem's power supply voltages.

Remote Datalogger. Displays the relative amount of data stored in the remote modem's data logger memory, from empty to full.



Signal and Noise Levels. Displays the relative levels of the received signal and noise, from low to high.

Data Displays

As shown in Figure 5-2 on page 5-6, there are two data displays: a Terminal display and an Input display. The Terminal display displays data and commands that are input to the local modem over the serial interface or received from a remote modem over the acoustic link. The Input display displays messages that are to be transmitted from the local modem to the online remote modem. These messages can be typed directly from the keyboard of the PC that is running TelesonarPC.

Viewing of commands in the Terminal display can be enabled or disabled. In addition, the Terminal display can be cleared at any time. Messages viewed in the Input display are typed with Chat mode enabled or disabled. When enabled, the messages are transmitted only after pressing Enter. When disabled, the transmission of all characters, including backspaces, begins after typing has stopped for a period equal to the forwarding delay, or after one of the modem's four 4-kbyte transmit buffers is full. Refer to "Forwarding Delay S8" on page 7-19 for information on the forwarding delay.

Clearing the terminal display. To clear the Terminal display, choose File ➤ Clear Display.

Enabling and disabling viewing of commands. To enable viewing of all commands in the Terminal display, choose Diagnostic ➤ View Modem Commands ➤ Enable. To disable viewing, choose Disable.

Enabling and disabling Chat mode. To enable Chat mode, choose File ➤ Enable Chat Mode. To disable, choose Disable.

Displaying Warning Messages

A warning message is displayed only when the condition requiring the warning is detected. The warnings are shown in separate windows which can be closed by clicking OK to acknowledge the warning. In addition, the display of some of the warning messages can be enabled or disabled.

To enable the display of all warning messages choose Diagnostic ➤ Warning Messages ➤ Enable. To disable, choose Disable.

Updating the Status Displays for the Remote Modem

To update the Status displays for the online remote modem, choose Acoustic Communication ➤ Get Remote Status.

Battery Pack Capacity Usage and Deployment Length Calculations

TelesonarPC provides a convenient tool for calculating the required modem battery pack capacity usage based on the length of deployment and the amount of data to be transmitted. Two basis are provided: one calculates the required capacity for a short deployment where a single relatively large data file is to be transmitted; the other, the required capacity for a long deployment where relatively small data files are to be transmitted periodically. Both basis take into account the expected ambient temperature. In addition, and for both basis, TelesonarPC can calculate the maximum deployment length based on the total amount of data to be transmitted.

Transmitting a Relatively Large Data File—Short Deployment

Transmitting a relatively large data file over a short deployment causes the transmitter to quickly use a large portion of the modem battery pack capacity while the DSP/receiver uses only a small portion.

To calculate the battery pack capacity usage required to transmit a relatively large data file over a short deployment, or to calculate the maximum deployment length for the total amount of data to be transmitted under the same conditions:

1. Choose Predeployment ➤ Battery Capacity.

   The Battery Capacity Calculation dialog box shown in Figure 5-4 opens.

2. Select the Calculate Battery Capacity option to calculate the required battery pack capacity usage, or select the Calculate Battery Deployment Length option to calculate the maximum deployment length.

3. In the Battery Amp-Hours area of the Battery Capacity Calculation dialog box, select the battery pack used.

   If a custom battery pack is used, select the Custom option, and then enter the capacity in amp-hours in the text box.

4. Select the acoustic transmit baud rate in bits/sec from the Acoustic Baud Rate drop-down list box.

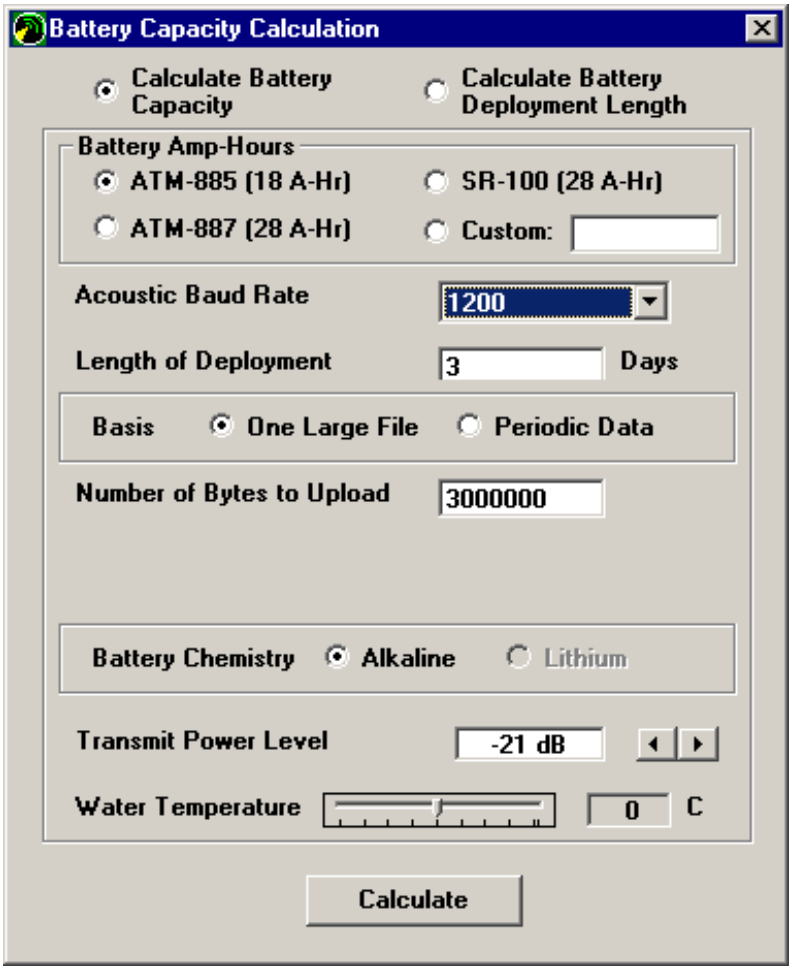
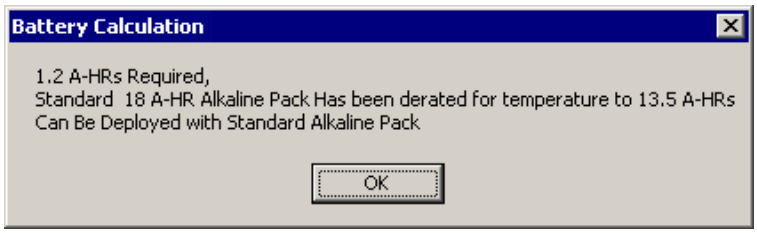


Figure 5-4 The Battery Capacity Calculation Dialog Box—Set up for Calculating Battery Pack Usage when Transmitting One Large File

5. Enter the expected length of deployment in days in the Length of Deployment text box, which is available only when calculating battery pack capacity usage.
6. Select the One Large File option for the basis.
7. Enter the expected number of bytes that will be transmitted in the Number of Bytes to Upload text box.
8. Select the transmit power level in decibels in the Transmit Power Level scroll box.
9. Select the expected ambient temperature in degrees Celsius using the Water Temperature slider.
10. Click Calculate to calculate and display the required battery pack capacity usage or the maximum deployment length.

For the battery pack capacity usage calculation, the Battery Calculation window opens with the battery pack capacity requirements displayed and a notification indicating whether the selected battery pack is adequate:



For the maximum deployment length calculation, the Battery Calculation window opens with the maximum number of days displayed for the type of battery pack selected.

11. Click OK in the Battery Calculation window, and then click the Cancel button in the Battery Pack Calculation dialog box to close it.

Transmitting Relatively Small Data Files Periodically—Long Deployment

Transmitting relatively small data files periodically over a long deployment causes the DSP/receiver to use a large portion of the modem battery pack capacity while the transmitter uses only a small portion.

To calculate the battery pack capacity usage required to transmit relatively small data files over a long deployment, or to calculate the maximum deployment length for the total amount of data to be transmitted under the same conditions:

1. Choose Predeployment ➤ Battery Capacity

   The Battery Capacity Calculation dialog box shown in Figure 5-5 opens.

2. Select the Calculate Battery Capacity option to calculate the required battery pack capacity usage, or select the Calculate Battery Deployment Length option to calculate the maximum deployment length.

3. In the Battery Amp-Hours area of the Battery Capacity Calculation dialog box, select the battery pack used.

   If a custom battery pack is used, select the Custom option, and then enter the capacity in amp-hours in the text box.

4. Select the acoustic transmit baud rate in bits/sec from the Acoustic Baud Rate drop-down list box.

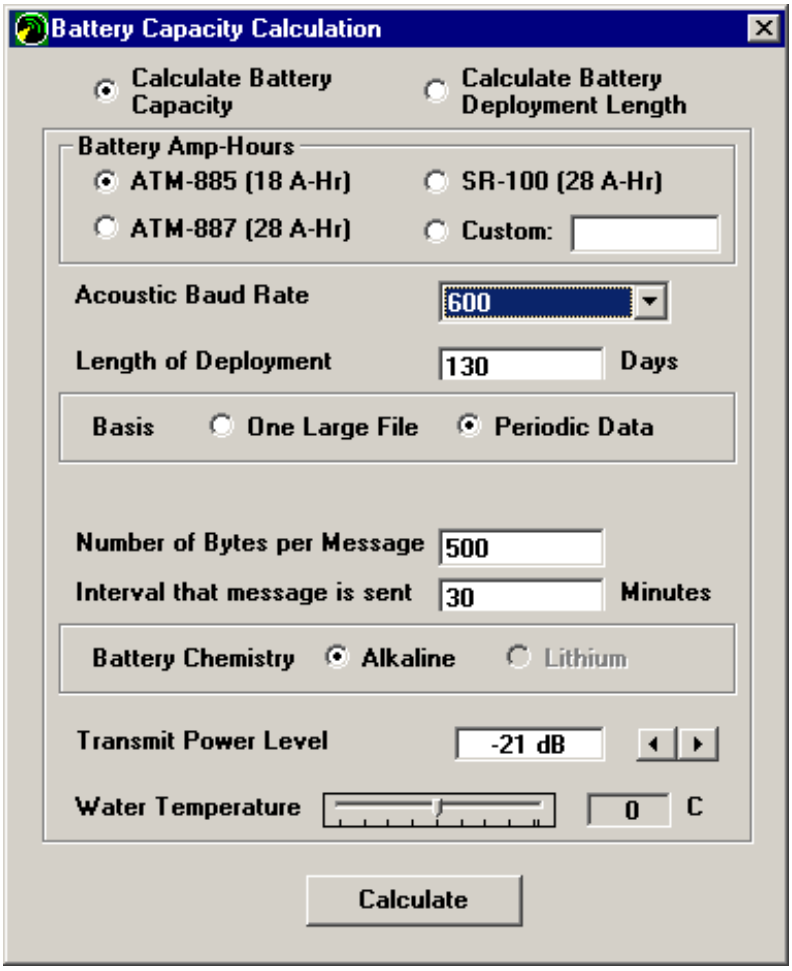
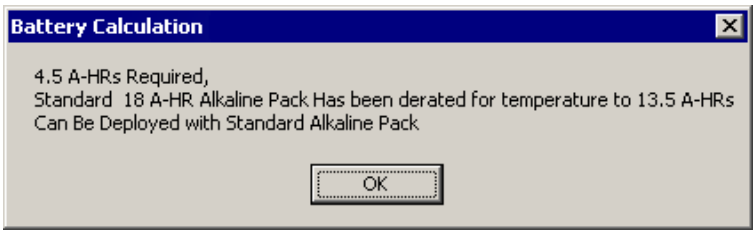


Figure 5-5 The Battery Capacity Calculation Dialog Box—Set up for Calculating Battery Pack Usage when Transmitting Data Periodically

5. Enter the expected length of deployment in days in the Length of Deployment text box, which is available only when calculating battery pack capacity usage.
6. Select the Periodic Data option for the basis.
7. Enter the expected number of bytes that will be transmitted for each message in the Number of Bytes per Message text box.
8. Enter the interval in minutes between transmissions in the Interval that Message is Sent text box.
9. Select the transmit power level in decibels in the Transmit Power Level scroll box.
10. Select the expected ambient temperature in degrees Celsius using the Water Temperature slider.

11. Click Calculate to calculate and display the required battery pack capacity usage or the maximum deployment length.

    For the battery pack capacity usage calculation, the Battery Calculation window opens with the battery pack capacity requirements displayed and a notification indicating whether the selected battery pack is adequate:



For the maximum deployment length calculation, the Battery Calculation window opens with the maximum number of days displayed for the type of battery pack selected.

12. Click OK in the Battery Calculation window, and then click the Cancel button in the Battery Pack Calculation dialog box to close it.

Configuring the Local and Remote Modems

To configure an ATM-880 or ATM-890 Series Acoustic Telemetry Modem, the modem must be connected to an available COM port on a PC, it must be switched on, and TelesonarPC must be running with the Main window open as shown in Figure 5-2 on page 5-6. The local and the remote modem's serial communications port and its operating parameters, or S Registers, can then be configured. A remote modem can also be configured remotely over the acoustic link.

Selecting and Configuring the Local Modem's Serial Communications Port

To select and configure the local modem's serial communications port:

1. Connect the local modem to the PC, turn it on and start TelesonarPC.
2. Choose Configuration ➤ PC Communications.

   The PC Communications dialog box shown in Figure 5-6 opens.

3. In the Baud Rate area of the PC Configuration dialog box, select the baud rate.

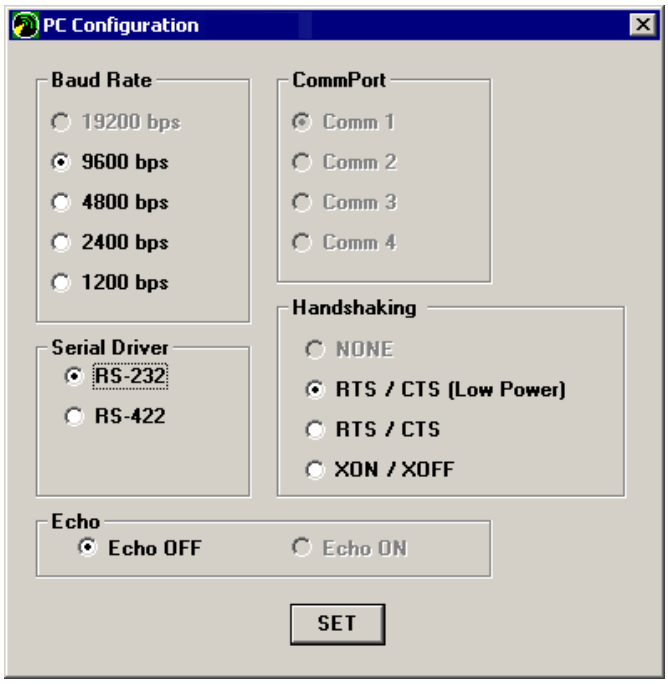


Figure 5-6 The PC Configuration Dialog Box

WARNING If the serial interface is changed from RS-232 to RS-422, an RS-422 serial interface connection to the modem is required to switch back to RS-232. The opposite applies after changing from RS-422 to RS-232.

4. In the Serial Driver area select the serial interface.

NOTE Selecting RTS/CTS (Low Power) turns off the RS-232 driver when the modem is in the lowpower state. Therefore, when making this selection, be sure hardware RTS/CTS handshaking at the host processor is disabled when the modem goes into the lowpower state, otherwise the modem will not input data over its serial interface. Selecting RTS/CTS maintains the driver on even when the modem is in the lowpower state but draws an additional 2 mA of current. Make this selection or use software XON/OFF handshaking if hardware RTS/CTS handshaking cannot be disabled. Refer to "RS-232 Driver/Flow Control S11" on page 7-25 for more information.

5. In the Handshaking area select the required handshaking.
6. Click SET to save the new selections and close the PC Configuration dialog box.

Selecting the Range Options

TelesonarPC calculates and displays the range from the local modem's transducer to the online remote modem's transducer in units of kilometers, meters, statute miles, feet, or nautical miles. The range is displayed in the Range Status display in the Main window when selecting Acoustic Communication from the Menu bar and then choosing Get Range. The range is also displayed in the Automatic Ranger window when using auto ranging as described in "Auto Ranging between the Local and Remote Modem's Transducers" on page 5-33. The range calculation is based on the default value of the speed of sound in water of 1500 meters per second. However, the units of range are selectable, and the speed of sound used in the calculation of range can be changed.

To select the units of range or to change the speed of sound in water used in the calculation of range, or both:

1. Choose Configuration ➤ Range Options.

   The Range Options dialog box shown in Figure 5-7 opens.

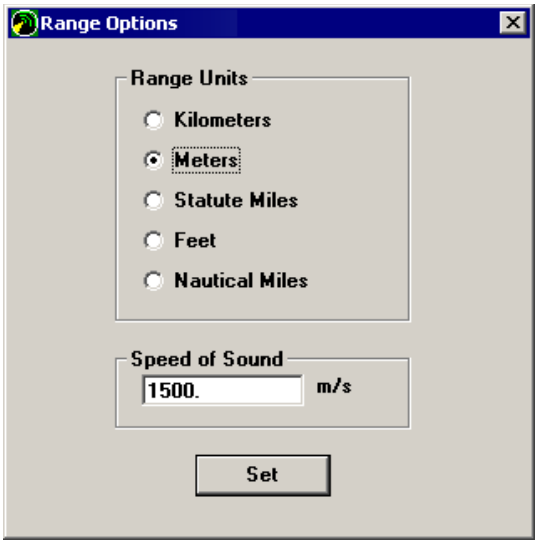


Figure 5-7 The Range Options Dialog Box

2. In the Range Units area of the Range Options dialog box, select the units of range.
3. Select the speed of sound in meters/sec in the Speed of Sound area.
4. Click Set to save the new settings and close the Range Options dialog box.

Selecting Units of Relative Speed

TelesonarPC calculates and displays the relative speed between the local and remote modem's transducers in units of knots or kilometers/hour. The relative speed is displayed in the Relative Speed Status display in the Main window, and the units of relative speed can be selected.

To select the units of relative speed:

1. Choose Configuration ➤ Speed Units.

   The Relative Speed Units dialog box shown in Figure 5-8 opens.

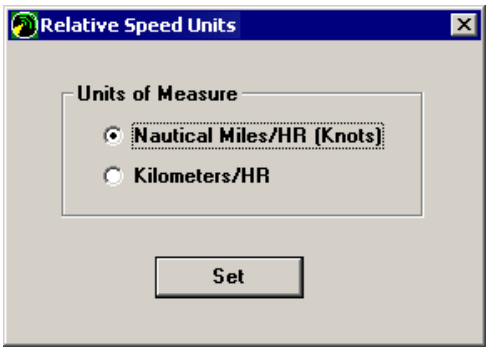


Figure 5-8 The Relative Speed Units Dialog Box

2. In the Units of Measure area of the Relative Speed Units dialog box, select the units of relative speed.
3. Click Set to save the new settings and close the Relative Speed Units dialog box.

Configuring the Local Modem's Operating Parameters (S Registers)

To configure the local modem's operating parameters:

1. Connect the local modem to the PC, turn it on and start TelesonarPC.
2. Choose Configuration ➤ Local Modem.

   The Local Modem Configuration dialog box shown in Figure 5-9 opens.

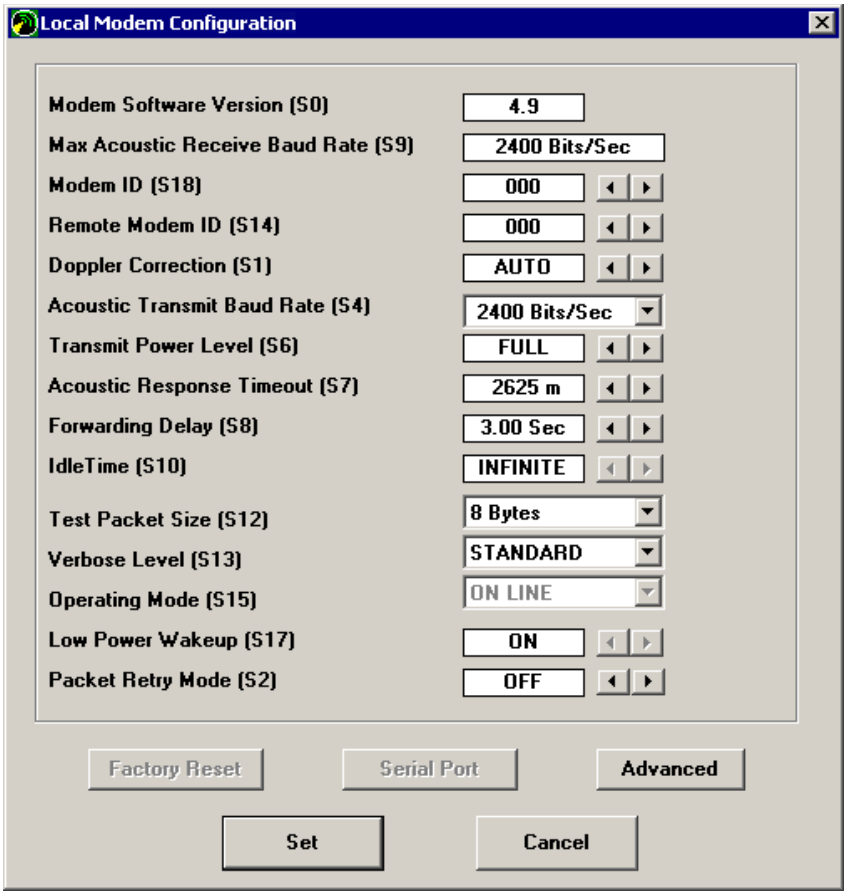


Figure 5-9 The Local Modem Configuration Dialog Box

The Local Modem Configuration dialog box is used to configure the local modem's operating parameters, which are controlled by its S Register settings. It can also be used to set its frequency band using an advanced setup.

NOTE For detailed information on the S Registers, refer to Table 7-1 on page 7-2, which lists all of the available S Registers and the page references to where detailed descriptions and available settings are provided.

NOTE In the Local Modem Configuration dialog box, buttons, arrows and entries in drop-down list boxes that are dimmed, are not available. In addition, the entry in the Modem Software Version (S0) text box and the Max Acoustic Receive Baud Rate (S9) text box cannot be changed.

3. In the Local Modem Configuration dialog box, select the address of this modem using the left or right arrow for the Modem ID (S18) scroll box.
4. In the Remote Modem ID (S14) scroll box, select the address of the remote modem that this modem will go online with when it is powered up or is awakened from its lowpower state.

   This setting applies only when Operating Mode (S15) is set to ON LINE, which is the default setting in the Local Modem Configuration dialog box and cannot be changed.
5. Select ENABLE in the Doppler Tracking (S1) scroll box to enable Doppler tracking, or DISABLE to disable Doppler tracking.

   Select DISABLE if the local and remote modems are a fixed distance apart.
6. Select the acoustic transmit baud rate in bits/sec from the Acoustic Transmit Baud Rate (S4) drop-down list box.
7. Select the transmit power level in decibels in the Transmit Power Level (S6) scroll box.
8. Select the distance between this modem and the remote modem in meters in the Acoustic Response Timeout (S7) scroll box.
9. Select the forwarding delay in seconds in the Forwarding Delay (S8) scroll box.
10. From the Test Packet Size (S12) drop-down list box, select the test packet size in bytes that this modem will command a remote modem to send when the Acoustic Link Test command (ATXn) is sent to the remote modem. Refer to "Acoustic Link Test ATXn" on page 6-27 for information on the ATXn command.
11. Select the level of messaging that this modem will provide from the Verbose Level (S13) drop-down list box.
12. Select ENABLE in the Packet Retry Mode (S2) scroll box to enable packet retry, or DISABLE to disable packet retry.
13. Click Set to output the new settings to the modem and close the Local Modem Configuration dialog box.

Advanced Local Modem Settings

The advanced local modem settings determine the local modem's frequency band. Typically, this setting is made at the factory and does not require changing. However, it can be changed if necessary.

WARNING Changing the frequency band may degrade performance. To ensure optimum performance, verify that the new setting matches the frequency band (LF, MF or HF) of the modem or the modem and its remote transducer.

To change the local modem's frequency band:

1. Choose Configuration ➤ Local Modem.

   The Local Modem Configuration dialog box shown in Figure 5-9 on page 5-19 opens.

2. Click Advanced.

   The Advanced Modem Settings dialog box shown in Figure 5-10 opens.

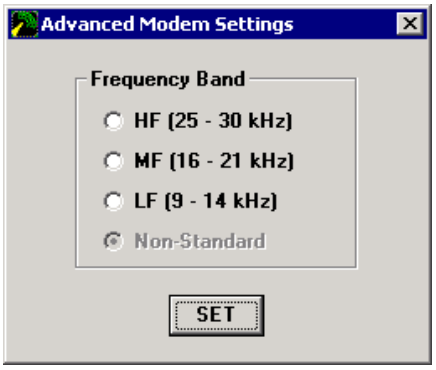


Figure 5-10 The Advanced Modem Settings Dialog Box

3. In the Frequency Band area, select the frequency band.
4. Click SET to save the new settings and close the Advanced Modem Settings dialog box, and then click Set or the Cancel button in the Local Modem Configuration dialog box.

Configuring the Remote Modem's Operating Parameters (S Registers)—before Deployment

To configure a remote modem's operating parameters before deployment:

1. Connect the remote modem to the PC, turn it on and start TelesonarPC.
2. Choose Predeployment ➤ Configure Modem.

   The Predeployment Configuration dialog box shown in Figure 5-11 opens.

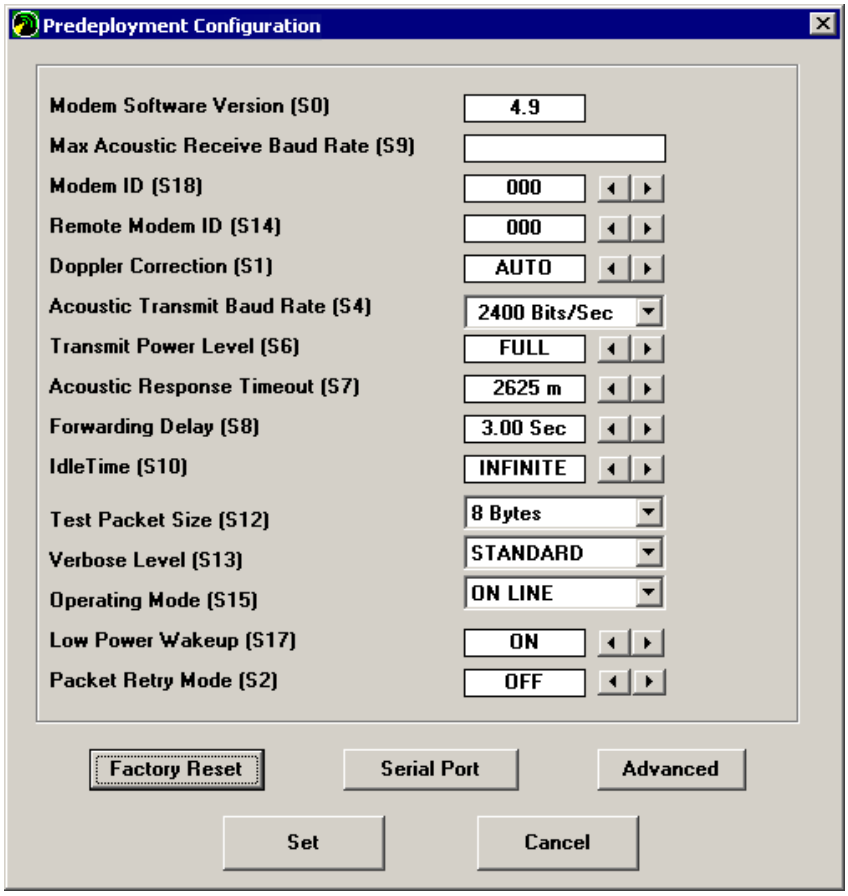


Figure 5-11 The Predeployment Configuration Dialog Box

The Predeployment Configuration dialog box is used to configure the remote modem's operating parameters, which are controlled by its S Register settings. It can also be used to configure the modem's serial communications port, reset its factory settings and, using an advanced setup, set its frequency band.

NOTE For detailed information on the S Registers, refer to Table 7-1 on page 7-2, which lists all of the available S Registers and the page references to where detailed descriptions and available settings are provided.

NOTE In the Predeployment Configuration dialog box, the entry in the Modem Software Version (S0) text box and the Max Acoustic Receive Baud Rate (S9) text box cannot be changed.

3. In the Predeployment Configuration dialog box, select the address of this modem using the left or right arrow for the Modem ID (S18) scroll box.
4. In the Remote Modem ID (S14) scroll box, select the address of the modem that this modem will go online with when it is powered up or is awakened from its lowpower state.

   This setting applies only when Operating Mode (S15) is set to ON LINE.
5. Select ENABLE in the Doppler Tracking (S1) scroll box to enable Doppler tracking, or DISABLE to disable Doppler tracking.

   Select DISABLE if the local and remote modems are a fixed distance apart.
6. Select the acoustic transmit baud rate in bits/sec from the Acoustic Transmit Baud Rate (S4) drop-down list box.
7. Select the transmit power level in decibels in the Transmit Power Level (S6) scroll box.
8. Select the distance between this modem and the modem that it will go online with in meters in the Acoustic Response Timeout (S7) scroll box.
9. Select the forwarding delay in seconds in the Forwarding Delay (S8) scroll box.
10. Select the idle time in seconds, or select INFINITE, in the Idle Time (S10) scroll box. In general, select INFINITE only for an ATM-891 Deck Box, and if it is not being powered by batteries.
11. From the Test Packet Size (S12) drop-down list box, select the test packet size in bytes that this modem will command another modem to send when the Acoustic Link Test command (ATXn) is sent to that

modem. Refer to "Acoustic Link Test ATXn" on page 6-27 for information on the ATXn command.

12. Select the level of messaging that this modem will provide from the Verbose Level (S13) drop-down list box.

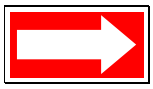
13. Select the operating mode from the Operating Mode (S15) drop-down list box.

    For this modem to go online with the modem whose address is the setting of Remote Modem ID (S14) when this modem is powered up or awakened from the lowpower state, select ON LINE.

14. Select ON in the Low Power Wakeup (S17) scroll box to enable transmission of the lowpower wakeup signal, or OFF to disable the lowpower wakeup signal.

    Select OFF if the receiving modem will never be in the lowpower state.

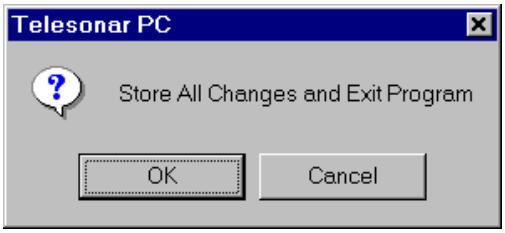
15. Select ENABLE in the Packet Retry Mode (S2) scroll box to enable packet retry, or DISABLE to disable packet retry.



NOTE To reset all the settings to their factory default settings, click Factory Reset.

16. Click Set to close the Predeployment Configuration dialog box.

    A TelesonarPC window opens asking whether to store the changes and exit the program:



17. Click OK to store the changes and exit TelesonarPC, or click Cancel to close the window without saving any changes and leave TelesonarPC running.

18. Disconnect the modem from the PC.

    The modem is ready for deployment.

Advanced Remote Modem Settings

The advanced remote modem settings determine the remote modem's frequency band. Typically, this setting is made at the factory and does not require changing. However, it can be changed if necessary. In addition, this setting can only be made with the modem connected to the PC. It cannot be set remotely.

WARNING Changing the frequency band may degrade performance. To ensure optimum performance, verify that the new setting matches the frequency band (LF, MF or HF) of the modem or the modem and its remote transducer.

To change the remote modem's frequency band:

1. Connect the modem to the PC and start TelesonarPC.
2. Choose Predeployment ➤ Configure Modem.

   The Predeployment Configuration dialog box shown in Figure 5-11 on page 5-22 opens.
3. Click Advanced.

   The Advanced Modem Settings dialog box shown in Figure 5-10 on page 5-21 opens.
4. In the Frequency Band area, select the frequency band.
5. Click SET to save the new settings and close the Advanced Modem Settings dialog box, and then click Set or the Cancel button in the Remote Modem Configuration dialog box.

   Clicking Set opens a TelesonarPC window which asks whether to store the changes and exit the program. If this window opens, click OK or the Cancel button. Clicking OK exists TelesonarPC.

Configuring the Remote Modem's Operating Parameters (S Registers)—after Deployment

A remote modem's operating parameters can also be configured remotely over the acoustic link after deployment. The procedure is similar to that provided for configuring the modem before deployment.

To configure a remote modem's operating parameters after deployment:

1. Select the address of the remote modem in the Remote ID Status display, and then click SET.

   The Local modem goes online with the remote modem.

2. Choose Configuration ➤ Remote Modem.

   The Remote Modem Configuration dialog box shown in Figure 5-12 opens.

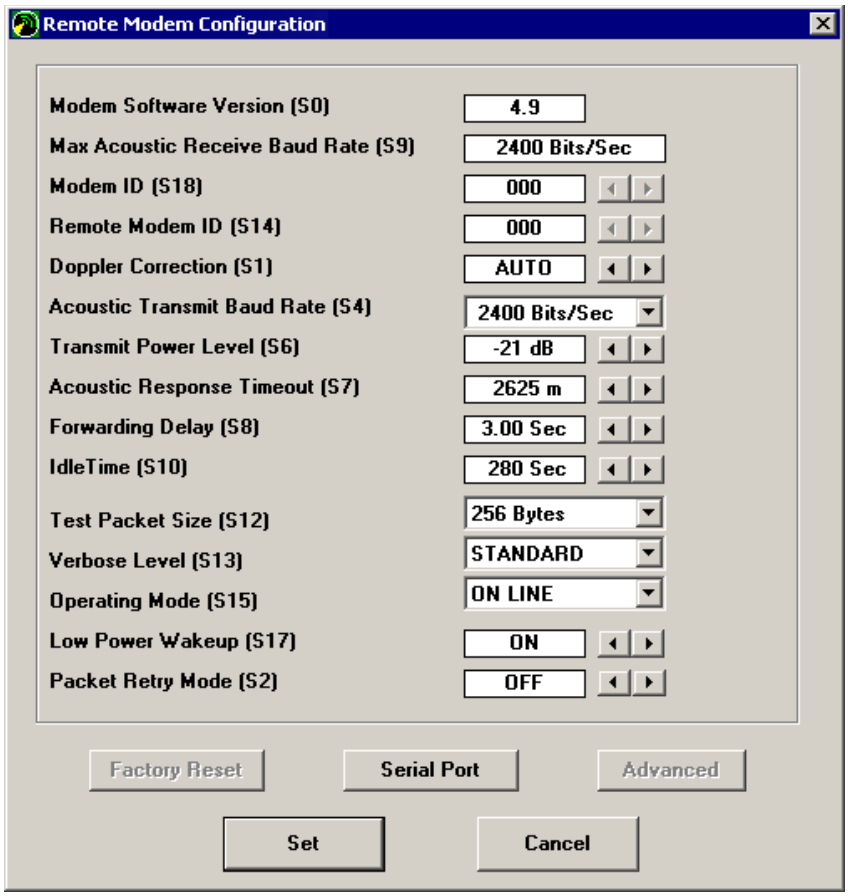


Figure 5-12 The Remote Modem Configuration Dialog Box

NOTE In the Remote Modem Configuration dialog box, buttons and arrows in drop-down list boxes that are dimmed, are not available. In addition, the entry in the Modem Software Version (S0) text box and the Max Acoustic Receive Baud Rate (S9) text box cannot be changed.

3. Select ENABLE in the Doppler Tracking (S1) scroll box to enable Doppler tracking, or DISABLE to disable Doppler tracking.

   Select DISABLE if the local and remote modems are a fixed distance apart.

4. Select the acoustic transmit baud rate in bits/sec from the Acoustic Transmit Baud Rate (S4) drop-down list box.

5. Select the transmit power level in decibels in the Transmit Power Level (S6) scroll box.

6. Select the distance between this modem and the modem that it will go online with in meters in the Acoustic Response Timeout (S7) scroll box.

7. Select the forwarding delay in seconds in the Forwarding Delay (S8) scroll box.

8. Select the idle time in seconds, or select INFINITE, in the Idle Time (S10) scroll box. In general, select INFINITE only for an ATM-891 Deck Box, and if it is not being powered by batteries.

9. From the Test Packet Size (S12) drop-down list box, select the test packet size in bytes that this modem will command another modem to send when the Acoustic Link Test command (ATXn) is sent to that modem. Refer to "Acoustic Link Test ATXn" on page 6-27 for information on the ATXn command.

10. Select the level of messaging that this modem will provide from the Verbose Level (S13) drop-down list box.

11. Select the operating mode from the Operating Mode (S15) drop-down list box.

    For this modem to go online with the modem whose address is the setting of Remote Modem ID (S14) when this modem is powered up or awakened from the lowpower state, select ON LINE.

12. Select ON in the Low Power Wakeup (S17) scroll box to enable transmission of the lowpower wakeup signal, or OFF to disable the lowpower wakeup signal.

    Select OFF if the receiving modem will never be in the lowpower state.

13. Select ENABLE in the Packet Retry Mode (S2) scroll box to enable packet retry, or DISABLE to disable packet retry.

14. Click Set to output the new settings to the modem and close the Remote Modem Configuration dialog box.

Configuring the Remote Modem's Serial Communications Port—after Deployment

A remote modem's serial communications port can also be configured remotely over the acoustic link after deployment. The procedure is similar to that provided for configuring the serial port before deployment.

To configure a remote modem's serial port after deployment:

1. Select the address of the remote modem in the Remote ID Status display, and then click SET.

   The local modem goes online with the remote modem.

2. Choose Configuration ➤ Remote Modem.

   The Remote Modem Configuration dialog box shown in Figure 5-12 on page 5-26 opens.

3. Click Serial Port. The Serial Port Configuration dialog box shown in Figure 5-13 opens.

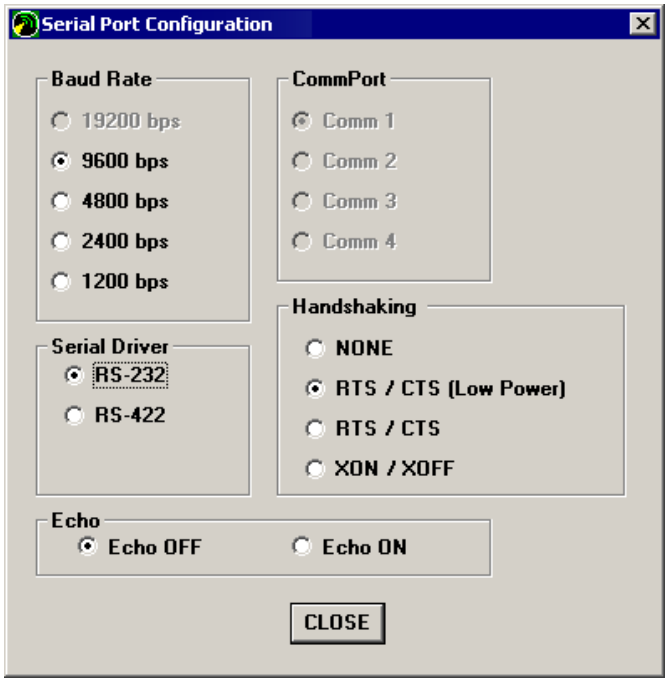


Figure 5-13 The Serial Port Configuration Dialog Box

NOTE The COM port setting in the CommPort area of the Serial Port Configuration dialog box cannot be changed remotely and therefore is unavailable.

4. In the Baud Rate area of the Serial Port Configuration dialog box, select the baud rate.
5. In the Serial Driver area select the serial interface.

NOTE Selecting RTS/CTS (Low Power) turns off the RS-232 driver when the modem is in the lowpower state. Therefore, when making this selection, be sure hardware RTS/CTS handshaking at the host processor is disabled when the modem goes into the lowpower state, otherwise the modem will not input data over its serial interface. Selecting RTS/CTS maintains the driver on even when the modem is in the lowpower state but draws an additional 2 mA of current. Make this selection or use software XON/OFF handshaking if hardware RTS/CTS handshaking cannot be disabled. Refer to "RS-232 Driver/Flow Control S11" on page 7-25 for more information.

6. In the Handshaking area select the required handshaking.
7. In the Echo area select the Echo ON or Echo OFF option.
8. Click CLOSE to close the Serial Port Configuration dialog box.
9. Click Set to close the Remote Modem Configuration dialog box and save the changes, or click the Cancel button to close the dialog box without saving any changes.

Configuring the Local and Remote Modems Using Auto Configuration

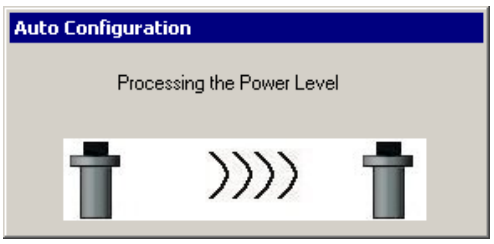
Auto configuration automatically configures both the local and remote modems at the highest acoustic transmit baud rate and the lowest transmit power level that will provide error free communications between the modems. Auto configuration ensures reliable operation while using the least amount of battery pack capacity.

NOTE Auto configuration will not automatically adjust to changing environmental conditions or changes to the separation or orientation of the modem's transducers. Should environmental or installation conditions change, auto configuration should be repeated.

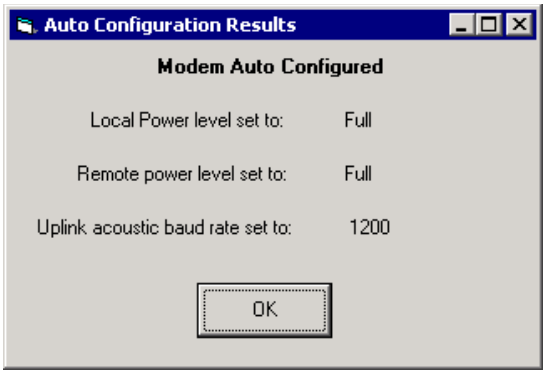
To auto configure the local and remote modems:

1. Choose Configuration ➤ Auto Configuration.

   The Auto Configuration window opens while TelesonarPC auto configures the modems:



   When the modems are configured, the Auto Configuration Results window opens:



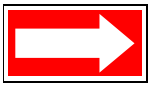
2. To close the Auto Configuration Results window, click OK.

Operating the Modems after Deployment

TelesonarPC provides a simple user interface for operating the ATM-880 and ATM-890 Series Acoustic Modems, including the SMART Releases, after they have been deployed. The operator functions include going online with different remote modems; checking the acoustic link and measuring the range between the local and remote modem's transducers; changing the local and a remote modem's transmit power level and acoustic transmit baud rate; enabling and disabling a remote modem's data logger; and checking, downloading, and clearing the contents of a remote modem's data logger memory. In addition, data received from a remote modem can be captured, or saved, to a file in real time, and data from a file can be uploaded to a remote modem. Telesonar PC also allows a break to be sent from the local host processor to an RD Instruments Acoustic Doppler Current Profiler that is connected to the online remote modem.

Going Online with a Different Remote Modem

To go online with a different remote modem, the address of the remote modem must be selected. Once selected, it remains selected until changed. To select the address of the remote modem, click the up or down arrow in the scroll box in the Remote ID Status display in the Main window until the desired address is displayed. When changed, the display turns blue. Then click SET. When the new address is set, the display turns back to black, and the local modem is online with the new remote modem.



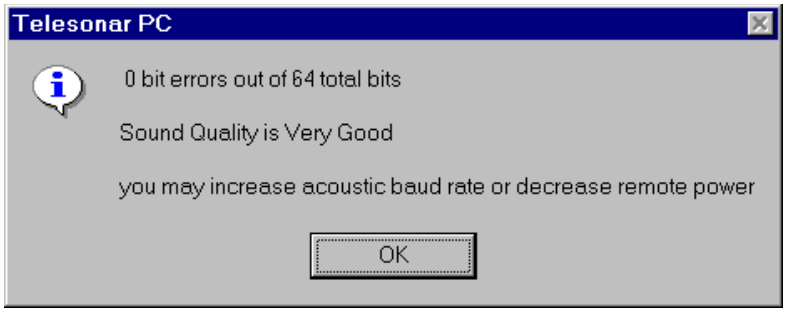
NOTE If the remote modem cannot be detected, the Remote Modem window shown in Figure 5-1 on page 5-4 opens. Follow the instructions in the window to try to detect the remote modem.

Checking the Acoustic Link between the Local and Remote Modems

To check the acoustic link between the local and remote modems:

1. Choose Acoustic Communication ➤ Test.

   The local modem commands the online remote modem to transmit a test message and the test message is evaluated with the results displayed in a TelesonarPC window:



2. To close the window, click OK.

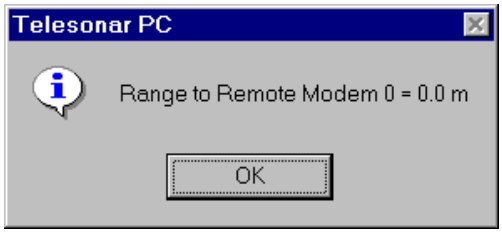
NOTE When checking the acoustic link in air, be sure to vary the separation of the transducers and the transmit power levels of either one or both of the modems as necessary to establish good communications. Refer to "Changing the Transmit Power Levels of the Local and Remote Modems" on page 5-34 for instructions on how to change the transmit power levels.

Checking the Range between the Local and the Remote Modem's Transducers

To check the range between the transducers of the local modem and the online remote modem:

1. Choose Acoustic Communication ➤ Get Range.

   The local modem acquires the range to the remote modem and a window opens with the range information displayed:



2. To close the window, click OK.

   The range is also displayed in the Range Status display in the Main window.

Auto Ranging between the Local and Remote Modem's Transducers

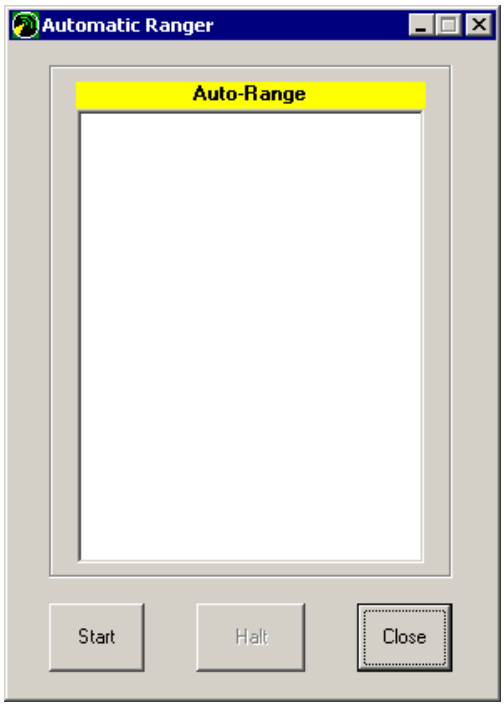
Auto ranging continuously acquires and displays the range between the transducers of the local modem and the online remote modem. Auto ranging is especially useful when relocating a SMART Release, as it allows a vessel to navigate to a position at which it will be easy to sight the release once it reaches the surface yet ensure it will surface a safe distance from the vessel.

WARNING The range is the slant, or direct, distance from the local modem's transducer to the remote modem's transducer, not the horizontal distance.

To auto range with the remote modem:

1. Choose Acoustic Communication ➤ Auto Range.

   The Automatic Ranger Window opens:

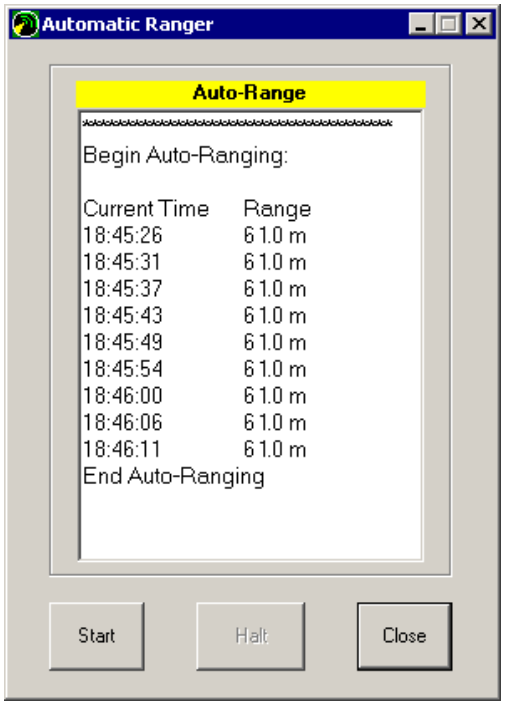


2. Click Start in the Automatic Ranger window.

   TelesonarPC begins acquiring and displaying the range to the remote modem in the Automatic Ranger window. The display is updated approximately every five seconds.

3. To end auto ranging, click Halt.

   Auto ranging stops and an end of auto ranging indication is displayed:



4. To close the Automatic Ranger window, click Close.

Changing the Transmit Power Levels of the Local and Remote Modems

To change the transmit power level of the local modem, click the up or down arrow in the drop-down list box in the Local Power Level Status display in the Main window until the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new power level is set, the display turns back to black.

To change the transmit power level of the online remote modem, click the up or down arrow in the drop-down list box in the Remote Power Level Status display in the Main window until the desired setting is displayed. Then click SET.

Changing the Acoustic Transmit Baud Rate of the Local and Remote Modems

To change the acoustic transmit baud rate of the local modem, click the up or down arrow in the Downlink drop-down list box in the Acoustic Baud Rate Status display in the Main window until the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new baud rate is set, the display turns back to black.

To change the acoustic transmit baud rate of the online remote modem, click the up or down arrow in the Uplink drop-down list box in the Acoustic Baud Rate Status display in the Main window until the desired setting is displayed. Then click SET.

Enabling and Disabling the Data Logger of the Remote Modem

The data logger of the online remote modem can be enabled or disabled. When the data logger is enabled, the modem is in Datalogger mode, and input from its host processor over the serial interface is treated as data and stored in the modem's data logger memory.

To enable the data logger of the remote modem, choose Datalogger ➤ Enable Datalogger. To disable the data logger of the remote modem, choose Datalogger ➤ Disable Datalogger.

Checking the Data Logger Memory of the Remote Modem

To check the data logger memory of the online remote modem:

1. Choose Datalogger ➤ Check Remote Buffer.

   The local modem commands the remote modem to transmit the number of bytes stored in its data logger memory, and the Remote Datalogger window opens with the number of bytes displayed:

The relative amount of data stored in the remote modem's data logger memory is also displayed in the Remote Datalogger Status display in the Main window.

2. To close the Remote Datalogger window, click OK.

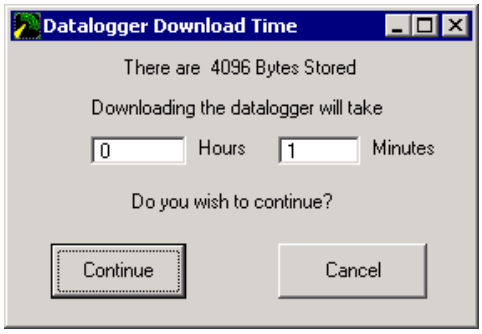
Downloading the Contents of the Remote Modem's Data Logger Memory to a File

The contents of the remote modem's data logger memory can be downloaded directly to a file on the PC.

To download the contents of the remote modem's data logger memory to a file:

1. Choose Datalogger ➤ Download Remote Buffer.

   The Datalogger Download Time window opens:



2. If applicable, verify that the remote modem's battery pack capacity is adequate for transmitting the amount of data displayed in the Datalogger Download Time window. Refer to "Battery Pack Capacity Usage and Deployment Length Calculations" on page 5-11 for information on how to calculate battery pack capacity usage.
3. Click Continue to select or to create the file to which to save the data, or click Cancel to close the Datalogger Download Time window.

   Clicking continue opens the Datalogger File dialog box shown in Figure 5-14.

4. Click the arrow in the Save in drop-down list box and select the folder in which to save the data file.
5. In the File name text box enter the name of the file in which to save the data.

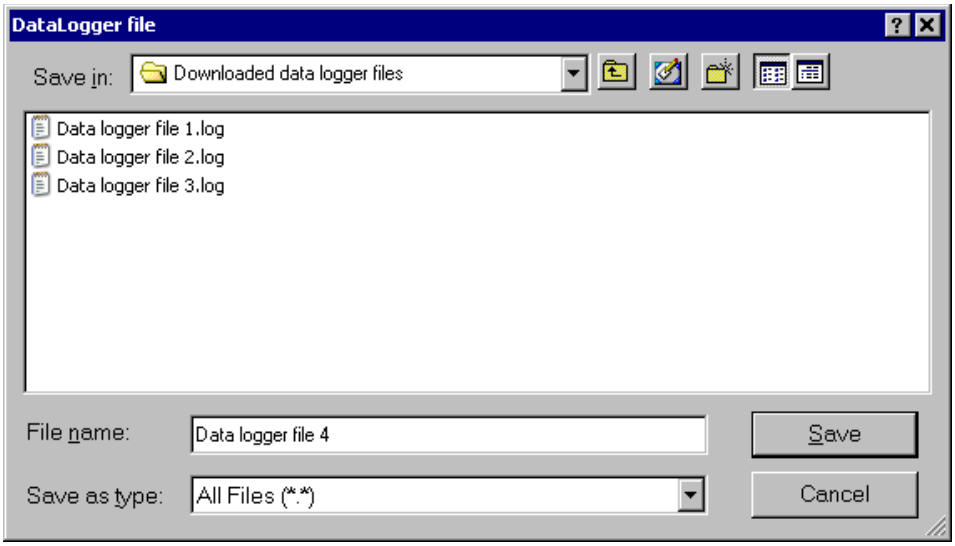


Figure 5-14 The DataLogger File Dialog Box

6. Click Save to save the data to the specified file and close the DataLogger File dialog box.

   The Downloading Datalogger window opens, and the contents of the remote modem's data logger memory are downloaded to the file. The progress bar in the Downloading Datalogger window displays the progress of the downloading process. When downloading is finished, the Download Complete window opens.

7. To close the Download Complete window, click OK.

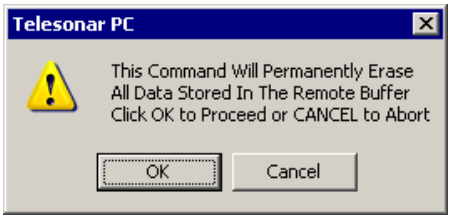
Clearing the Contents of the Remote Modem's Data Logger Memory

The contents of the data logger memory of the online remote modem can be cleared.

To clear the contents of the data logger memory of the remote modem:

1. Choose Datalogger ➤ Clear Remote Buffer.

   A TelesonarPC window opens asking whether to proceed or cancel:



2. Click OK to clear the data logger memory and close the TelesonarPC window, or click Cancel to close the window without clearing the data logger memory.

NOTE To verify that the data logger memory of the remote modem is cleared, check the data logger memory by choosing Datalogger ➤ Check Remote Buffer as described in "Checking the Data Logger Memory of the Remote Modem" on page 5-35.

Capturing Received Data from the Remote Modem

When receiving data from a remote modem, the data can be captured, or saved, to a file in real time.

To capture the received data:

1. Choose File Transfer ➤ Capture.

   The Capture File dialog box shown in Figure 5-15 opens.

2. Click the arrow in the Save in drop-down list box and select the folder in which to save the data file.

3. In the File name text box enter the name of the file in which to save the data.

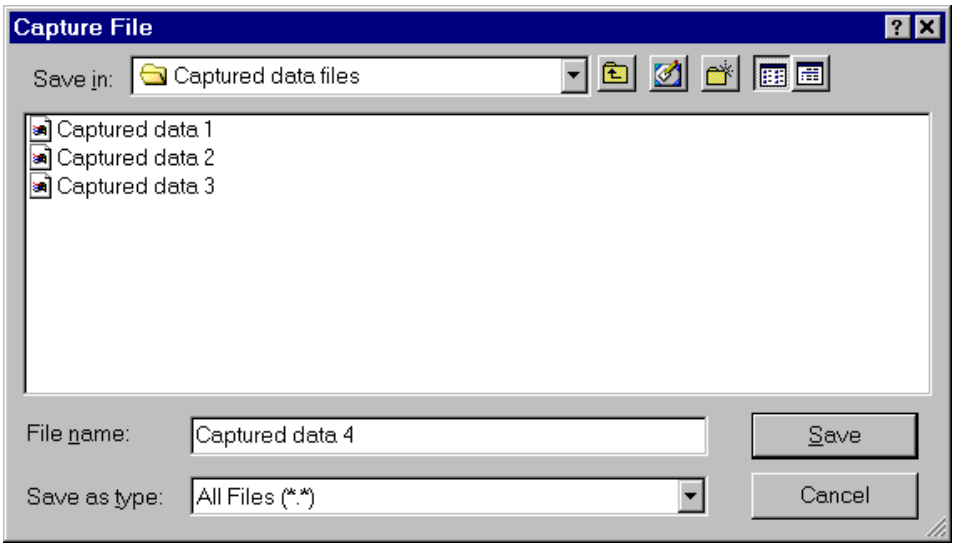


Figure 5-15 The Capture File Dialog Box

4. Click Save to save the data to the specified file and close the Capture File dialog box.

   CAPTURE ON is displayed on the Status bar, and the received data are saved to the file.

5. To stop the capture of received data, Choose File Transfer ➤ Capture.

   CAPTURE OFF is displayed on the Status bar and the received data are no longer saved.

Uploading Data from a File to the Remote Modem

Data from a file can be uploaded to the online remote modem. The data are transferred directly from a file on the PC to the remote modem, and from the remote modem to its host over the serial interface.

To upload data from a file to a remote modem:

1. Choose File Transfer ➤ Send File.

   The Open File to Upload dialog box shown in Figure 5-16 opens.

   If the data file is not listed, it may be in a different folder than the one shown. If this is the case, click the arrow in the Look in drop-down list box and select the folder in which the file is located.

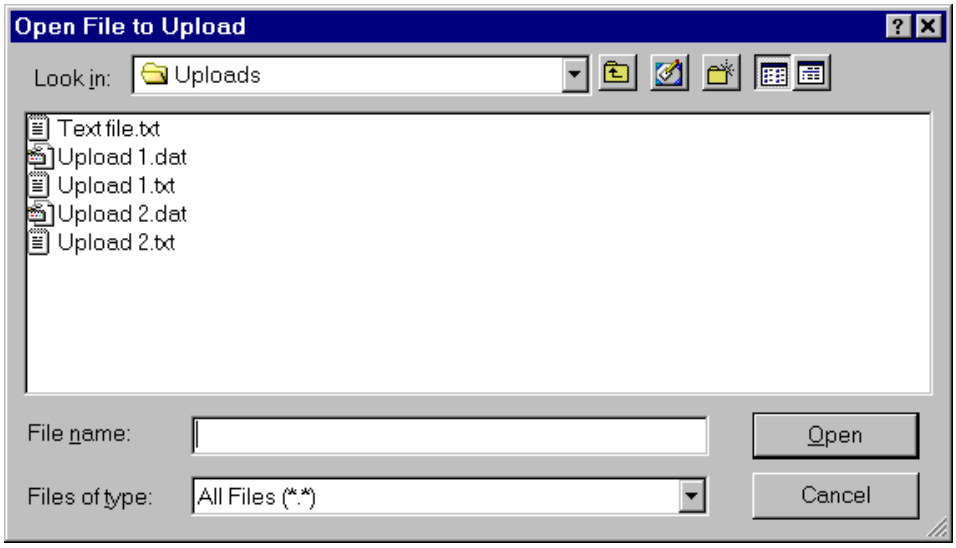
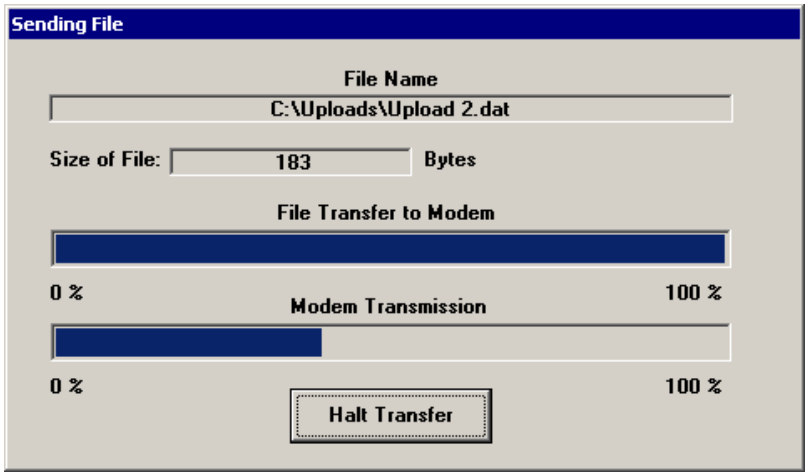


Figure 5-16 The Open File to Upload Dialog Box

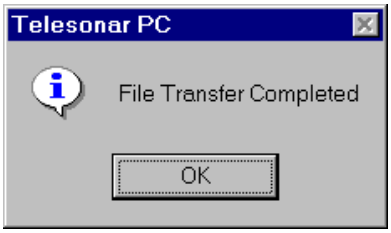
2. Click the file name of the file to be opened, and then click Open.

   The Sending File window opens and the data are uploaded:



   The uploading of data can be stopped by clicking Halt Transfer. However, data will be uploaded until all data received by the modem over the serial interface have been transmitted.

   After the uploading is complete, the Sending File window closes and a TelesonarPC window opens acknowledging the file transfer:



3. To close the window, click OK.

Sending a Break to the Remote Modem

The local modem that is connected to a PC will detect a break if it is sent over the serial interface from the PC. The local modem will send a command to the online remote modem which will cause the remote modem to send the equivalent break on its serial interface. If the remote modem is connected to an RD Instruments Acoustic Doppler Current Profiler, the break will wake up and reset the current meter. Therefore, the current meter performs in the same manner as it would if it received the break directly from the PC.

To send a break to the remote modem, and have the modem send the break on its serial interface, choose Acoustic Communication ➤ Send RDI Break.

Operating a SMART Release

In addition to the standard modem operator functions, TelesonarPC includes commands for acquiring and displaying the status of a SMART Release and activating its release mechanism.

NOTE As the SMART Release is also an ATM-880 Acoustic Telemetry Modem, all the operator functions described in "Operating the Modems after Deployment" on page 5-31 apply to the SMART Release.

Checking the Status of a SMART Release

The status of a SMART Release can be checked at any time, even after the release mechanism has been activated. The status information includes whether the release is armed, released—and confirmed, or released—and not confirmed; whether the release is tilted; and whether the battery voltage is low.

To check the status of a SMART Release:

1. Select the address of the SMART Release in the Remote ID Status display, and then click SET.

   The local modem goes online with the SMART Release.

2. Choose Acoustic Communication ➤ Check Release Status.

   The Release Status window opens and displays the status information:

3. To close the Release Status window, click OK.

Activating the Release Mechanism of a SMART Release

Activating the release mechanism of a SMART Release requires both the address of the modem and its release code. The address and the release code are printed on the label that is attached to the SMART Release housing.

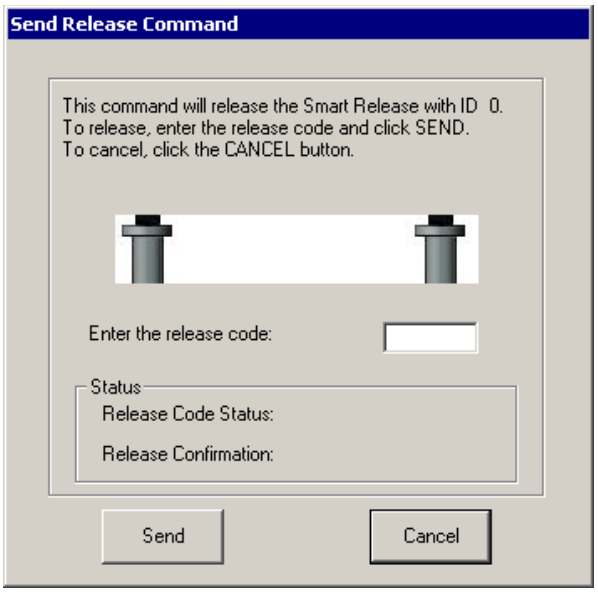
To activate the release mechanism of a SMART Release:

1. Select the address of the SMART Release in the Remote ID Status display, and then click SET.

   The local modem goes online with the SMART Release.

2. Choose Acoustic Communication ➤ Send Release Command.

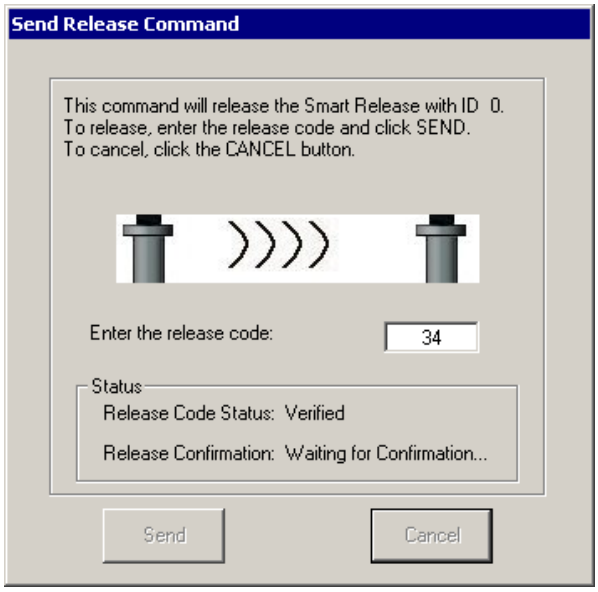
   The Send Release Command dialog box opens:



3. In the Send Release Command dialog box, enter the release code in the Enter the release code text box.

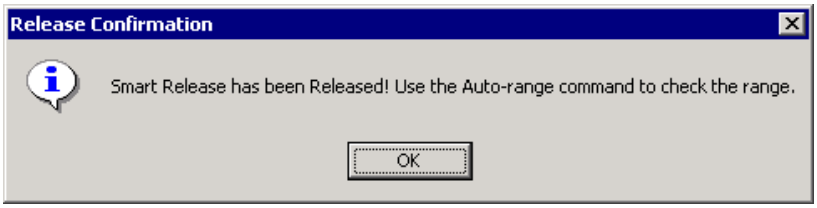
4. Click Send.

   If the release code is correct, "Verified" is displayed for the Release Code Status in the Status area of the Send Release Command dialog box, and "Waiting for Confirmation" is displayed for the Release Confirmation:



If the release code is incorrect, "Invalid Code" will be displayed for the Release Code Status, and "Aborted" will be displayed for Release Confirmation.

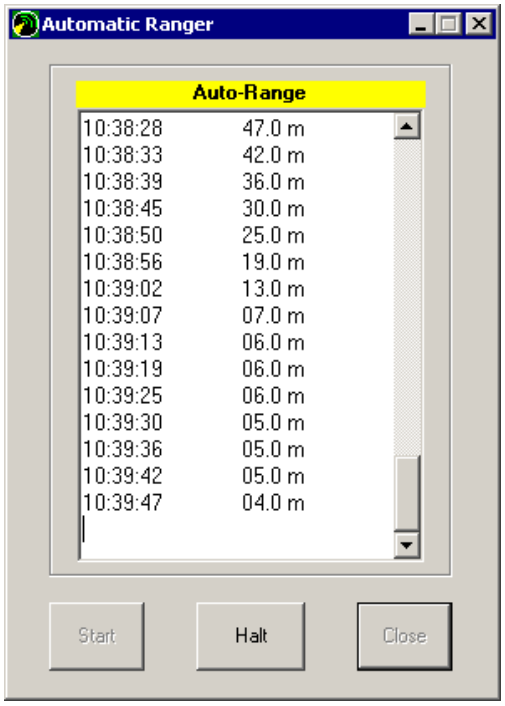
If the correct release code was received, the Release Confirmation window should open, which acknowledges that the release mechanism has been activated and that the SMART Release has released itself from its mooring:



If, instead, a Warning window opens indicating that the release mechanism has been activated but not confirmed, then the release has not released itself from its mooring. In this case, click OK to close the Warning window, and then again click Send in the Send Release Command dialog box which remains open.

5. If the Release Confirmation window opens, click OK.

   The Send Release Command dialog box closes, and the Automatic Ranger window opens to assist in relocating the release as it ascends to the surface:



6. To end auto ranging and close the Automatic Ranger window, click Halt and then Close.

Modem Diagnostics

TelesonarPC provides several diagnostic functions which help to evaluate modem performance. These diagnostic functions allow viewing the local and remote modem battery pack voltages, viewing the background noise detected by the local modem's receiver, and commanding the local modem to ping continuously to verify that its transmitter is functioning. In addition, the local modem's firmware version number can be checked.

Checking the Battery Pack Voltages

To check the local modem's battery pack or power supply voltage, choose Diagnostic ➤ Local Battery Check. The voltage of the local modem's battery pack or power supply is displayed in the Battery Voltage Status display. If the voltage is too low, a Warning window also opens with the voltage displayed.

To check the battery pack voltage of the online remote modem, choose Diagnostic ➤ Remote Battery Check. The voltage of the remote modem's battery pack is displayed in the Battery Voltage Status display. If the voltage is too low, a Warning window also opens with the voltage displayed.

Viewing the Background Noise Level of the Local Modem

The relative background noise level detected by the local modem's receiver can be viewed in real time in continuous one second intervals. However, when the noise test is being performed, data transmitted by a remote modem will be indicated as noise in the display, and the data will not be received or displayed by TelesonarPC.

To view the background noise level:

1. Choose Diagnostic ➤ Noise Test.

   The Noise Test window shown in Figure 5-17 opens.

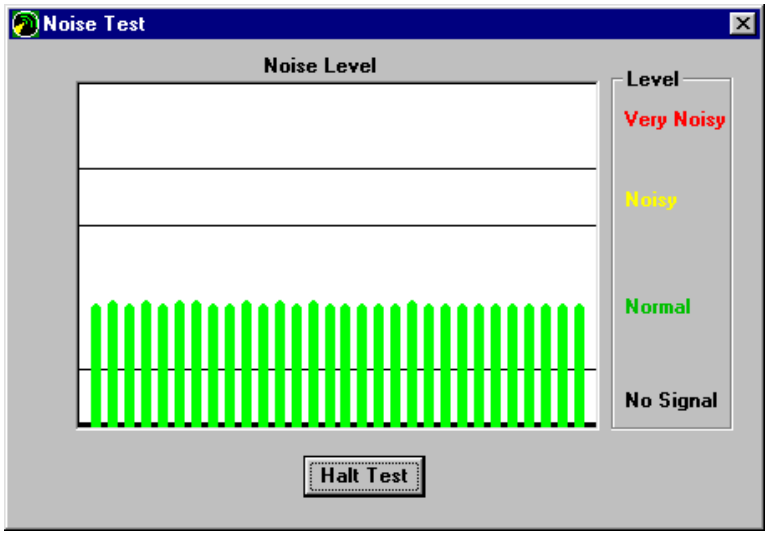


Figure 5-17 The Noise Test Window

   The noise profile begins scrolling from the left to the right of the display. Profiles in green indicate a normal level of noise. Yellow and red indicate high and very high levels of background noise, respectively. Generally, an acceptable level of background noise is present when the maximum amplitude of the noise profile is below the bottom two thirds of the display.

   If the noise profile is black, there is no signal, which could mean there is no transducer connected or there is a problem with the transducer or modem receiver.

2. Click Halt Test or the Cancel button to stop the test and close the Noise Test window.

Performing the Ping Test

The ping test verifies that the local modem's transmitter is functioning.

To perform the ping test:

1. Choose Diagnostic ➤ Ping Test.

   The Ping Test dialog box shown in Figure 5-18 opens. In addition, PING TEST is displayed on the Status bar.

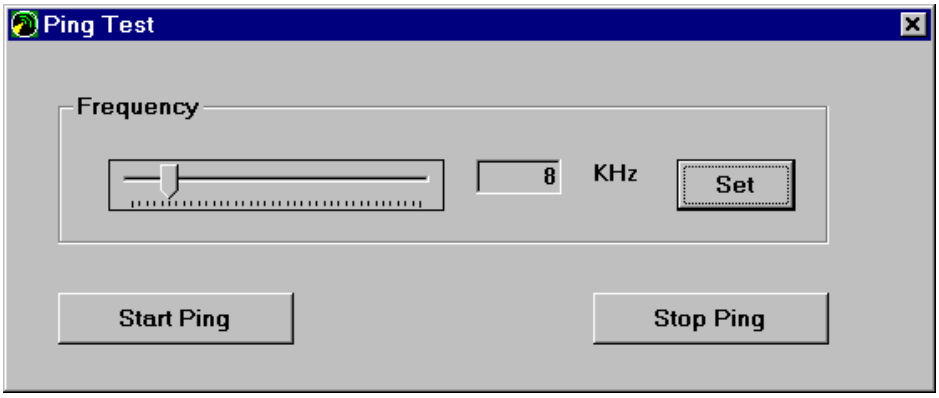


Figure 5-18 The Ping Test Dialog Box

WARNING Selecting a frequency that is not in the frequency band of the modem's transducer may result in damage to the transmitter.

2. Select the frequency in kilohertz using the Frequency slider.

   When changed, the displayed frequency turns from black to blue.

3. Click SET.

   The new frequency is set and the display turns back to black.

4. Click Start Ping.

   The local modem is commanded to ping at a 0.800-ms rate (1.25 Hz) at the selected frequency, and with a pulse width of 3.125 ms.

WARNING If the modem uses a battery pack for power, and the modem is left pinging for an extended period, the battery pack will be depleted.

5. To stop the ping test and leave the Ping Test dialog box open, click Stop Ping; to stop the ping test and close the dialog box, click the Cancel button.

Checking the Local Modem's Firmware Version Number

To check the local modem's firmware version number:

1. Choose Diagnostic ➤ Version.

   The Modem Version window opens:

2. To close the Modem Version window, click OK.

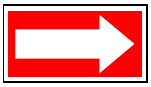
NOTE The local modem's firmware version number is not the TelesonarPC version number. To check the TelesonarPC version number, choose Help ➤ About TelesonarPC.

6 Modem Operating Modes and Commands

This section provides an overall description of the ATM-880 and ATM-890 Series Acoustic Telemetry Modem operating modes, along with descriptions of each of the modem commands and how to enter and use them. The operating modes determine how a modem handles data and commands. The modem commands, which are input to a modem from its host processor over the serial interface, control the operation of the modem. An understanding of the operating modes and commands is important when integrating and operating the modems with other subsea instrument packages.

The modem commands are listed in Table 6-1 on page 6-12. Also listed in the table are the page references to where detailed descriptions of the commands are provided.

Although the modem commands control the operation of the modems, the operating parameters, which are determined from settings that are stored in 21 nonvolatile memory locations called S Registers, directly affect how many of the commands are applied and how a modem functions in each of its operating modes. For a detailed description of the S Registers and how to set them, refer to Section 7, "Modem Operating Parameters (S Registers)." Many of the S Registers are called out in this section.



NOTE TelesonarPC cannot be used to enter modem commands. The modem must be connected to a computer that is set up to run a terminal program, such as ProComm Plus, Hyperterminal or DumbTerm. DumbTerm is available from RD Instruments. Refer to "Setting Up the Modems" on page 4-7 for instructions on how to connect the modem to a PC and how to set up the PC as the local host processor.

Operating Modes

The ATM-880 and ATM-890 Series Acoustic Telemetry Modems operate in three distinct operating modes: Online mode, Command mode, and Datalogger mode. Essentially, the operating modes determine how a modem handles input from its host processor over the serial interface. In Online mode the input is treated as data which are freely exchanged between the local and

remote host processors. In Command mode the input is treated as commands which instruct the modem to perform various functions, including sending commands to remote modems. In Datalogger mode the input is also treated as data, but in this case the data are stored in the flash memory of the modem's data logger. At any time these data can be transmitted acoustically to another modem. When a modem is powered up, it immediately goes into one of the three operating modes as determined by the setting of S Register 15: 00 for Command mode, 01 for Online mode, or 02 for Datalogger mode. However, after powering up, it is possible to change the operating mode, regardless of the setting of S Register 15.

Online Mode

When a modem is in Online mode and is online with a remote modem, input from its host processor over the serial interface is treated as data which are freely exchanged between the local and remote host processors.

A modem will go into Online mode when it is powered up *only* if S Register 15 is set to 01, which is the factory default setting. In this case any input to the modem over the serial interface is transmitted to the remote modem whose address is the setting of S Register 14. Therefore, setting S Register 15 to 01 allows the modem to go online automatically with any remote modem whose address is the setting of S Register 14 after being powered up or awakened from its lowpower state.

A modem can be placed into Online mode in any of the following ways:

Using the Dial command (ATDn). From Command mode only, entering the Dial command will cause the modem to go into Online mode and to go online with the remote modem at address n.

Using the Online command (ATO). From Command mode only, entering the Online command will cause the modem to go into Online mode and to go online with the modem whose address is the setting of S Register 14. The Online command also sets S Register 15 to 01.

Setting S Register 15 to 01. From Command mode only, setting S Register 15 to 01 will cause the modem to go into Online mode and to go online with the remote modem whose address is the setting of S Register 14.

Using the Lowpower State command (ATL)—S Register 15 set to 01. From Command mode only *and* if S Register 15 is set to 01, entering the Lowpower State command will place the modem into Online mode. The

modem will also go into the lowpower state. When awakened, the modem will be online with the remote modem whose address is the setting of S Register 14.

Allowing the idle time to expire—S Register 15 set to 01. If S Register 15 is set to 01, allowing the idle time to expire will place the modem into Online mode. The modem will also go into the lowpower state. When awakened, the modem will be online with the remote modem whose address is the setting of S Register 14.

Cycling power—S Register 15 set to 01. If S Register 15 is set to 01, powering down the modem and then powering up the modem will place the modem into Online mode and the modem will be online with the remote modem whose address is the setting of S Register 14.

Receiving a Dial command (ATDn) from a remote modem. If the modem receives a Dial command from a remote modem, the modem will go into Online mode and go online with the remote modem.

Receiving a Remote Data Logger Disable command (AT$BDn) when it is in Datalogger mode. If the modem receives a Remote Data Logger Disable command from another modem *and* it is in Datalogger mode, the modem will go into Online mode, and S Register 15 will be set to 01.

Device Enable

Device Enable is an output provided by all the modems except the ATM-891 Deck Box. Refer to "Setting Up the Modems" on page 4-7 for connection information. Device Enable can be used to switch on a modem's host processor when the modem is ready to send data to it that were received over the acoustic link, and to switch off the host processor when the modem is in the lowpower state, such as when it receives the Hangup command (ATH), the Lowpower State command (ATL) or the idle time expires. If the Device Enable output is off, it will turn on *only* if the modem receives data over the acoustic link, 80 ms prior to sending the data to the host, or if it receives the Dial command (ATD). When the Device Enable output is on, it will switch up to 80 mA to ground. When it is off, it is a high impedance. Refer to Section 2, "Specifications," for additional electrical specifications.

Transmit Data Buffers

Each modem includes four internal 4-kbyte transmit data buffers for a total buffer size of 16 kbytes. This allows data that are input to the modem over the serial interface to be organized into four packets of 4 kbytes. After a transmit

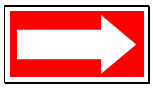
data buffer has filled, the modem immediately transmits the data. If data are input to the modem, but the transmit data buffer does not fill, the modem will wait a preset time—called the forwarding delay—after the last data are input, and then transmit the partial packet. The forwarding delay is determined by the setting of S Register 8 and ranges from 50 milliseconds to 5 seconds.

WARNING If the Online Interrupt command (+++) is entered to place the modem into Command mode while data remains in the 4-kbyte transmit data buffer, the data will not be transmitted and the buffer will be cleared. Refer to "Online Interrupt +++" on page 6-15 for information on the Online Interrupt command.

The 4-kbyte transmit data buffers also allow a faster serial interface baud rate than the acoustic baud rate. For example, the serial interface baud rate can be 9600 bits/sec while the acoustic baud rate is 600 bits/sec. However, when the serial interface baud rate is faster than the acoustic baud rate, no more than 16 kbytes of data can be input to the modem without loss of data unless handshaking is used.

WARNING If handshaking is *not* used and data are input to the modem when all four of the 4-kbyte transmit data buffers are full, the data will be ignored, hence lost.

Although the use of handshaking, which uses the RS-232 signal RTS, is optional, it is highly recommended when more than 16 kbytes of data are to be transmitted and packet retry, as determined by the setting of S Register 2, is disabled; 12 kbytes if enabled. Refer to "Packet Retry S2" on page 7-7 for information on S Register 2. Handshaking will ensure there is no loss of data, as when the four 4-kbyte transmit data buffers are full, handshaking will not allow the host processor to output data to the modem.



NOTE While data are being transmitted from a 4-kbyte transmit data buffer, data can continue to be input to the modem over the serial interface, filling the additional 4-kbyte transmit data buffers.

Refer to "Setting Up the Modems" on page 4-7 for information on how to set up the modems. The recommended setup uses the RS-232 handshaking signal RTS when connecting the modems.

Data Format

Data, including parity, that are input to the modem over the serial interface when the modem is in Online mode can be in any format that fits into 8-bit bytes. For example, the data can be 7 bits with parity, 8 bits with no parity, or 8-bit binary words. However, it cannot be 8 bits with parity.

Online Break

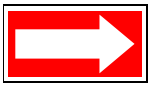
A local modem that is connected to a PC will detect a break if it is sent over the serial interface from the PC. If the local modem is online with a remote modem, it will command the remote modem to send the equivalent break on its serial interface. If the remote modem is connected to an RD Instruments Acoustic Doppler Current Profiler (ADCP), the break will wake up and reset the current meter. Therefore, the current meter essentially performs in the same manner as it would if it received the break directly from the PC.

Error Checking

With each 4-kbyte data packet transmitted, a checksum is calculated and also transmitted. The modem that receives the packet also calculates a checksum and compares it to the transmitted checksum. If enabled with the setting of S Register 13, the received data statistics comprising the checksum pass or fail results (CRC), the multipath delay (MPD), the signal-to-noise ratio (SNR), the relative speed between the local and remote modems (SPD), the automatic gain control output (AGC), and the corrected channel errors (CCERR) are displayed. Refer to "Acoustic Link Test ATXn" on page 6-27 for a detailed description of the received data statistics. S Register 13 must be set to 02 or 03 for the received data statistics to be displayed.

Command Mode

When a modem is in Command mode, input from its host processor over the serial interface is treated as commands. A modem will go into Command mode when it is powered up *only* if S Register 15 is set to 00.



NOTE The factory default setting of S Register 15 is 01, which causes the modem to go into Online mode when it is powered up.

When powered up in Command mode, and if a PC is used as the host processor, the monitor will display the banner message. The message includes the frequency band (LF, MF, HF, or Nonstandard), the firmware version, and the command prompt (>) as shown in the following example:

Benthos ATM-88X
MF Frequency Band
Acoustic Modem Version 5.0
>

To display this message and many other messages, S Register 13 must be set to 01, 02, or 03 where 01 is the factory default setting.

In Command mode any of the commands can be entered. There are two basic types of commands: commands that are executed by the local modem—the modem where the commands are entered over the serial interface—and commands that are sent by the local modem over the acoustic link to be executed by a remote modem. The commands perform a number of different functions: configuring the local modem's S Register settings, going online with a remote modem, reading a remote modem's S Register settings, testing the acoustic link between the local and remote modems, and many others. When a command is entered, the modem will indicate the execution of the command with a message and then display the command prompt (>).

A modem can be placed into Command mode in any of the following ways:

Using the Online Interrupt command (+++). Entering the Online Interrupt command will place the modem into Command mode. Refer to "Online Interrupt +++" on page 6-15 for information on the Online Interrupt command.

Cycling power—S Register 15 set to 00. If S Register 15 is set to 00, powering down the modem and then powering up the modem will place the modem into Command mode.

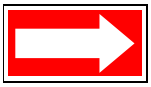
Allowing the idle time to expire—S Register 15 set to 00. If S Register 15 is set to 00, allowing the idle time to expire will place the modem into Command mode and into the lowpower state. Refer to "Lowpower State" below for information on the lowpower state and the idle time.

Lowpower State

In any of the operating modes, when there is no input to the modem either from its host processor over the serial interface or from a remote modem over the acoustic link, the modem will go into the lowpower state after a preset time. The lowpower state conserves battery power as only the modem's receiver is active. The preset time is the idle time and is determined by the setting of S Register 10. When the modem goes into the lowpower state, the message "Lowpower" is displayed on the monitor of the host PC if a PC is used as the host processor. The idle time is reset to zero when the modem receives input either from its host processor or from a remote modem.

WARNING Although the idle time can be set to prevent the modem from going into the lowpower state for an indefinite time, if the modem is being powered by batteries, this setting will rapidly deplete the capacity of the modem battery pack. Hence if batteries are being used to power the modem, it is important that the idle time be set as short as possible.

When a modem is in the lowpower state, its receiver is still active. Therefore, it can be awakened by input either from its host processor over the serial interface or from a remote modem over the acoustic link.



NOTE For the modem to be awakened acoustically, a lowpower wakeup signal must be transmitted by the transmitting modem. To enable the transmission of the lowpower wakeup signal, set S Register 17 of the transmitting modem to 01.

If the modem is awakened by the host processor, it immediately goes into the operating mode determined by the setting of S Register 15. If the modem receives a signal over the acoustic link from a remote modem, it immediately checks the signal to see if it is being addressed—either with its unique address or with the global address that is the same for all the modems. If the modem does not recognize its address or the global address, it remains in the lowpower state. If it recognizes the signal as containing a valid address, it will go out of the lowpower state and into the operating mode determined by the setting of S Register 15.

NOTE When a modem is not being powered by batteries—typically for the ATM-891 Deck Box—the idle time should be set to prevent the modem from going into the lowpower state for an indefinite time. This improves operating efficiency as the modem never has to be reawakened from its lowpower state. The idle time can be set to indefinite by setting S Register 10 to 255.

Acoustic Command Execution

When a modem receives a command over the acoustic link, it will respond in one of the following ways:

Go into one of two of the operating modes. If the command is the Dial command (ATDn), then the modem will go into Online mode; if it is the Remote Data Logger Disable command (AT$BDn) *and* the modem is in Datalogger mode, then also Online mode; if it is the Remote Data Logger Enable command (AT$BEn), then Datalogger mode.

Go into the lowpower state. If the command is the Hang Up command (ATH), the modem will go into the lowpower state without transmitting an acknowledgment.

Transmit an acknowledgment. If the command is one that does not require that the modem transmit back specific information, the modem will execute the command and transmit an acknowledgment. For example, if a modem receives the Remote Power command (AT$Pn,m), it executes the command by setting the transmit power level to level m, and then it transmits an acknowledgment at the new transmit power level.

Transmit information. If the command is one that requires that the modem transmit back specific information, the modem will transmit the requested information. For example, if a modem receives the Remote Register command (AT$Sn), it executes the command by transmitting its S Register settings.

Datalogger Mode

When a modem is in Datalogger mode, input from its host processor over the serial interface is treated as data which are stored in the flash memory of the modem's data logger. Up to 704 kbytes of data can be stored. A modem will go into Datalogger mode when it is powered up *only* if S Register 15 is set to 02. Data stored in the data logger memory are *not* lost when the modem is

powered down. The contents of the data logger memory of a remote modem can be read or cleared at any time over the acoustic link. The number of bytes of data stored can also be read. The same is true for a local modem over the serial interface.

A modem can be placed into Datalogger mode in any of the following ways:

Setting S Register 15 to 02. From Command mode only, setting S Register 15 to 02 will place the modem into Datalogger mode.

Using the Lowpower State command (ATL)—S Register 15 set to 02. From Command mode only, if S Register 15 is set to 02, entering the Lowpower State command will place the modem into Datalogger mode and into the lowpower state.

Receiving a Remote Data Logger Enable command (AT$BEn). If the modem receives a Remote Data Logger Enable command from another modem, the modem will go into Datalogger mode, and S Register 15 will be set to 02.

Cycling power—S Register 15 is set to 02. If S Register 15 is set to 02, powering down the modem and then powering up the modem will place the modem into Datalogger mode.

Allowing the idle time to expire—S Register 15 is set to 02. If S Register 15 is set to 02, allowing the idle time to expire will place the modem into Datalogger mode and into the lowpower state.

When the modem is in Datalogger mode, data that are input to the modem over the serial interface are stored in an 8-kbyte temporary data buffer. After the temporary data buffer has filled, the data are immediately transferred to the data logger memory. If the temporary data buffer has not filled, the modem will wait a preset time—called the forwarding delay—after the last data are input, and then transfer the data. The forwarding delay is determined by the setting of S Register 8. The delay settings range from 50 milliseconds to 5 seconds.

WARNING If the Online Interrupt command (+++) is entered to place the modem into Command mode while data remains in the 8-kbyte temporary data buffer, the data will not be transferred and the buffer will be cleared.

When more than 8 kbytes of data are to be stored, the use of handshaking, which uses the RS-232 signal RTS, should be used to ensure there is no loss of data.

WARNING If handshaking is *not* used and data are input to the modem when the 8-kbyte temporary data buffer is full, or while the modem is transferring data from the temporary data buffer to the data logger memory, transmitting the contents of the data logger memory over the acoustic link, or clearing the contents of the data logger memory, the data will be ignored, hence lost.

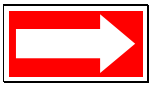
Handshaking will ensure there is no loss of data, as when the 8-kbyte temporary data buffer is full, or when data is being transferred to or transmitted from the data logger memory, or the contents of the data logger memory is being cleared, handshaking will not allow the host processor to output data to the modem.

Refer to "Setting Up the Modems" on page 4-7 for information on how to set up the modems. The recommended setup uses the RS-232 handshaking signal RTS when connecting the modems.

Entering Commands

Commands can only be entered when a modem has been connected to a host processor and is in Command mode. For information on how to set up the modem, refer to "Setting Up the Modems" on page 4-7. The commands are input to the modem from its host processor over the serial interface at the baud rate of the serial interface. The data format for the commands is ASCII with 8 bits, no parity and 1 stop bit.

The modem commands are listed in Table 6-1 on page 6-12. Also listed in the table are the page references to where detailed descriptions of the commands are provided.



NOTE Any reference to a local modem in the table or in the detailed descriptions refers to the modem to which commands and data are input from the host processor over the serial interface. Any reference to a remote modem refers to the modem to which acoustic commands are sent and from which data and acknowledgments are received over the acoustic link.

If an external PC is used as the host processor, commands can be entered from the keyboard and data and messages displayed on the monitor. Commands are entered at the command prompt (>), and every command must be followed by pressing Enter for the command to be executed.

To place the modem into Command mode, do one of the following:

- Enter +++ rapidly.
- If S Register 15 is set to 00, power down and then power up the modem.
- If S Register 15 is set to 00, wait for the idle time to expire.

The modem will go into Command mode and display the command prompt (>).

To enter a command, type the command in accordance with the commands listed in Table 6-1 and in the detailed descriptions of the commands that follow.

Table 6-1 ATM-880 and ATM-890 Series Acoustic Telemetry Modem Command Set

Command Syntax	Command Name	Result	Page
+++	Online Interrupt	Causes the local modem to go into Command mode.	6-15
AT [Enter]	Attention	Resets the local modem idle time timer and verifies communications between the host processor and the modem.	6-17
ATDn [Enter]	Dial	Causes the local modem to go into Online mode and to go online with the remote modem at address n.	6-19
AT&F [Enter]	Factory Reset	Resets the local modem's S Register settings to their factory default settings.	6-21
ATH [Enter]	Hang Up	Causes all the remote modems to go into the lowpower state.	6-23
ATO [Enter]	Online	Causes the local modem to go into Online mode from Command mode.	6-25
ATXn [Enter]	Acoustic Link Test	Tests the acoustic link with the modem at address n.	6-27
ATYn [Enter]	Multiple Baud Rate Test	Tests the acoustic link with the modem at address n at multiple baud rates.	6-29
AT$Pn,m [Enter]	Remote Power	Sets the transmit power level of the remote modem at address n to level m.	6-31
AT$An,m [Enter]	Remote Baud Rate	Sets the transmitting acoustic baud rate of the remote modem at address n to m.	6-33
ATSn? [Enter]	Read Register	Displays the setting of the local modem's S Register n.	6-35
AT$Sn [Enter]	Read Remote Registers	Displays the S Register settings of the remote modem at address n.	6-37
ATSn=n [Enter]	Set Register	Sets the local modem's S Register number n to the value entered following "=."	6-39
AT&W [Enter]	Write	Saves the local modem's S Register settings as the new startup configuration.	6-41

Table 6-1 ATM-880 and ATM-890 Series Acoustic Telemetry Modem Command Set (Continued)

Command Syntax	Command Name	Result	Page
ATL [Enter]	Lowpower State	Forces the idle time of the local modem to expire, which in turn causes the modem to go into the lowpower state	6-43
ATRn [Enter]	Range	Displays the range from the local modem to the remote modem at address n.	6-45
AT$Dn,m [Enter]	Remote Doppler Tracking	Enables or disables Doppler tracking of the remote modem at address n.	6-47
ATV [Enter]	Local Battery Voltage	Displays the DSP/receiver and transmitter power supply voltages of the local modem.	6-49
AT$Vn [Enter]	Remote Battery Voltage	Displays the DSP/receiver and transmitter power supply voltages of the remote modem at address n.	6-51
AT$BEn [Enter]	Remote Data Logger Enable	Causes the remote modem at address n to go into Datalogger mode.	6-53
AT$BDn [Enter]	Remote Data Logger Disable	Causes the remote modem at address n to go into Command mode if it is in Datalogger mode.	6-55
AT$BTn [Enter]	Read Remote Data Logger	Displays the contents of the data logger memory of the remote modem at address n.	6-57
AT$BBn,m [Enter]	Output Data Logger Block	Outputs block m of the remote modem at address n.	6-59
AT$BCn [Enter]	Clear Remote Data Logger	Clears the contents of the data logger memory of the remote modem at address n.	6-61
AT$BNn [Enter]	Remote Bytes Stored	Displays the number of bytes of data stored in the data logger memory of the remote modem at address n.	6-63
ATBC [Enter]	Clear Local Data Logger	Clears the contents of the data logger memory of the local modem.	6-65
ATBN [Enter]	Local Bytes Stored	Displays the number of bytes of data stored in the data logger memory of the local modem.	6-67

Table 6-1 ATM-880 and ATM-890 Series Acoustic Telemetry Modem Command Set (Continued)

Command Syntax	Command Name	Result	Page
ATBT [Enter]	Output Local Data Logger	Outputs the contents of the data logger memory of the local modem over the serial interface.	6-69
ATBPn [Enter]	Output Local Page	Outputs the contents of page n of the data logger memory of the local modem over the serial interface.	6-71
ATTNn [Enter]	AGC Diagnostic	Enables or disables the display of the automatic gain control (AGC) output of the local modem.	6-73
AT$Tn [Enter]	Release Status	Displays the status of the SMART Release at address n.	6-75
AT$Rn,m [Enter]	Release	Activates the release mechanism of the SMART Release at address n with release code m.	6-77

Online Interrupt +++

Syntax

+++

Definition

The Online Interrupt command causes the local modem to go into Command mode. When a local modem is in Online mode and is online with a remote modem, every character that is input to the local modem from its host processor over the serial interface is transmitted to the remote modem. Similarly, every character that is input to the remote modem from its host processor over the serial interface is transmitted to the local modem. However, if the characters +++ are typed in rapid succession when the local modem is not transmitting or receiving data, either over the serial interface or over the acoustic link, the modem will switch to Command mode, and the remote modem will remain in Online mode. Similarly, when the local modem is in Datalogger mode, every character that is input to the modem from its host processor over the serial interface is stored in the modem's data logger memory. And if the characters +++ are typed in rapid succession when the modem is not transmitting or receiving data, either over the serial interface or over the acoustic link, the local modem will switch to Command mode.

WARNING If +++ is entered after data have been input to the modem over the serial interface, but before the forwarding delay has elapsed, the data will be lost. The setting of S Register 8 determines the forwarding delay.

How to Use

To use the Online Interrupt command, type +++ rapidly.

The local modem will indicate that it has gone into Command mode by displaying the command prompt (>).

Special Considerations

The Online Interrupt command uses three plus characters—typed in rapid succession—because of the low probability that a string of three plus signs would be part of any data stream. To further ensure that these characters are not part of a data stream, the local modem requires three additional conditions for recognizing an interrupt:

1. There are no characters entered before the first plus sign is entered for a period that is longer than one second.
2. There are no other characters entered between entering any two plus signs.
3. The time interval between entering any two plus signs is less than one second.

The three conditions are shown graphically in Figure 6-1.

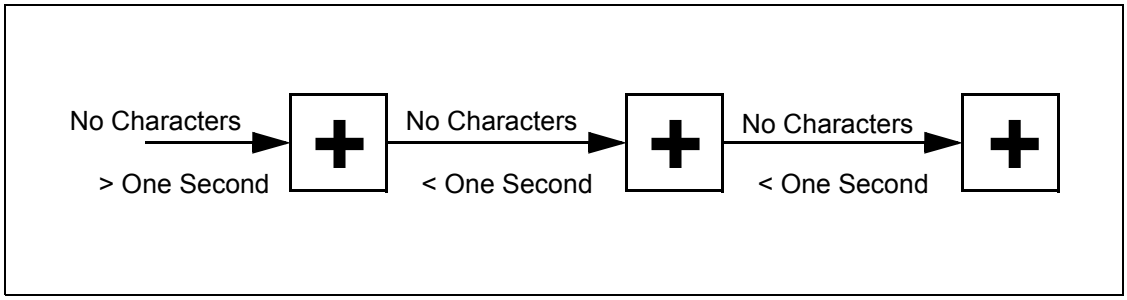


Figure 6-1 Conditions for Recognizing an Online Interrupt Command

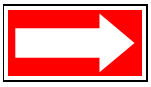
Attention AT

Syntax

AT [Enter]

Definition

The Attention command resets the local modem's idle time timer and verifies that the communications link between the host processor and the modem is functioning properly.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Attention command, type AT, and then press Enter.

The local modem will indicate that it has verified communications with its host processor by responding with the message "OK" and displaying the command prompt (>).

Special Considerations

To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.

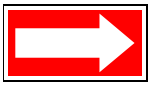
Dial ATDn

Syntax

ATDn [Enter]

Definition

The Dial command causes the local modem to go into Online mode from Command mode and to go online with the remote modem at address n.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Dial command, type ATD followed by the address of the remote modem, and then press Enter.

The local modem will go online with the remote modem, and then the local modem will display the message "CONNECT" followed by the transmitting acoustic baud rate of the local modem.

When the local and remote modems are online, the local modem will transmit all the data received from its host processor to the remote modem, which will in turn output the data to its host processor. Similarly, the remote modem will transmit all the data received from its host processor to the local modem, which will in turn output the data to its host processor.

Special Considerations

When using the Dial command, take note of the following:

- To display the message "CONNECT" followed by the transmitting acoustic baud rate and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by

the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

- The Dial command sets S Register 14 of the remote modem to the address of the local modem.
- The Dial command sets S Register 14 of the local modem to the address of the remote modem.
- If it is desired to enter commands after going online with the remote modem, type +++ in rapid succession to cause the local modem to go into Command mode. Then enter the desired commands. To go back online with the same remote modem, use the Dial command.
- If the remote modem goes into the lowpower state and S Register 15 is set to 00, then the modem will go into command mode. To go back online with the same remote modem, use the Dial command.

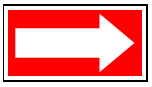
Factory Reset AT&F

Syntax

AT&F [Enter]

Definition

The Factory Reset command resets the local modem's S Register settings to their factory default settings.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Factory Reset command, type AT&F, and then press Enter.

The local modem will reset its S Registers to their factory default settings, and respond with the message "Factory Reset."

Special Considerations

When using the Factory Reset command, take note of the following:

- Using the Write command (AT&W) after using the Factory Reset command will save the S Register factory default settings as the startup configuration, which is the S Register settings when the modem is powered up.
- When the modem is powered up, the S Registers will be set to their startup configuration. This configuration is not necessarily the factory default settings, as the S Register settings may have been changed with the Set Register command (ATSn=n), and then saved as the new startup configuration with the Write command (AT&W).

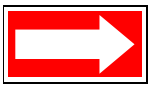
Hang Up ATH

Syntax

ATH [Enter]

Definition

The Hang Up command causes all the remote modems to go into the lowpower state. It is not possible to send a Hang Up command to a specific modem.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Hang Up command, type ATH, and then press Enter.

The local modem will send the Hang Up command to address FF, which each modem will recognize as one of its addresses. When the local modem has completed the transmission, it will respond with the message "Off Line."

Special Considerations

When using the Hang Up command, take note of the following:

- To display the message "Off Line" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- When a remote modem receives the Hang Up command, it will not send an acknowledgment to the local modem. Instead, it will cease transmissions and go into the lowpower state.
- Because a remote modem goes into the lowpower state when it receives the Hang Up command, its Device Enable output will turn off. Refer to "Device Enable" on page 6-3 for information on the Device Enable output.

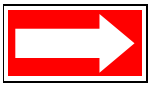
Online ATO

Syntax

ATO [Enter]

Definition

The Online command causes the local modem to go into Online mode from Command mode and to go online with the remote modem whose address is the setting of the local modem's S Register 14. The command also sets the local modem's S Register 15 to 01. This setting ensures the modem will remain online after the local modem is powered down and then powered up again, or is awakened from the lowpower state.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Online command, type ATO, and then press Enter.

The local modem will go online with the remote modem, and then the local modem will display the message "CONNECT" followed by the transmitting acoustic baud rate of the local modem.

When the local and remote modems are online, the local modem will transmit all the data received from its host processor to the remote modem, which will in turn output the data to its host processor. Similarly, the remote modem will transmit all the data received from its host processor to the local modem, which will in turn output the data to its host processor.

Special Considerations

When using the Online command, take note of the following:

- To display the message "CONNECT" followed by the acoustic baud rate and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.

- If it is desired to enter commands after going online with the remote modem, type +++ in rapid succession to cause the local modem to go into Command mode. Then enter the desired commands. To go back online with the same remote modem, use the Online command.

Acoustic Link Test ATXn

Syntax

ATXn [Enter]

Definition

The Acoustic Link Test command tests the acoustic link between the local modem and the remote modem at address n by causing the remote modem to transmit one of 8 preset test messages at the acoustic baud rate determined by the setting of S Register 4 of the remote modem. Which preset test message is transmitted and whether the message is displayed when received by the local modem is determined by the setting of S Register 12.

In addition, the local modem measures and displays the following, which are the received data statistics:

ERR: Errors—the number of bits received that did not match the test message.

CRC: Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected.

MPD: Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50.

SNR: Signal to Noise Ratio—in dB, where the higher the value the better the acoustic environment.

SPD: Speed—the relative speed in knots between the local and remote modems, where a negative number indicates the modems are moving farther apart and a positive number indicates the modems are moving closer together.

AGC: Automatic Gain Control—a decimal number where the lower the number the less gain, which means a strong input signal was received. Similarly, the higher the number the more gain, which means a weak input signal was received. The lowest gain indication is 00, and the highest is 95.

CCERR: Corrected Channel Error—Metric 0–14.

NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Acoustic Link Test command, type ATX followed by the address of the remote modem, and then press Enter.

The remote modem will transmit the preset test message selected by the setting of the local modem's S Register 12 at the baud rate determined by the setting of the remote modem's S Register 4, and the local modem will display the received data statistics described above. In addition, depending on the setting of S Register 12, the local modem will display the preset test message which consists of the alphanumeric ASCII character set.

Special Considerations

When using the Acoustic Link Test command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- To optimize the performance and efficiency of the modems, consider reducing the transmit power level of the remote modem with the Remote Power command (AT$Pn,m) and use the Acoustic Link Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's transmitting acoustic baud rate by changing the setting of its S Register 4 with the Remote Baud Rate command (AT$An,m). Again, use the Acoustic Link Test command to verify a low error rate. Similarly, if a high error rate is observed, consider increasing the transmit power level or decreasing the transmitting acoustic baud rate, or both.

Multiple Baud Rate Test ATYn

Syntax

ATYn [Enter]

Definition

The Multiple Baud Rate Test command tests the acoustic link between the local modem and the remote modem at address n by causing the remote modem to transmit a 256-byte preset test message multiple times, one time for each of the acoustic baud rates listed below. Depending on the setting of S Register 12, the preset test message is displayed when received by the local modem. If the local modem is an ATM-880 Series Acoustic Telemetry Modem, six different acoustic baud rates are used to transmit the preset test message: 300, 600, 800, 1000, 1200, and 2400 bits/sec. If the local modem is an ATM-890 Series Acoustic Telemetry Modem, these baud rates plus five additional baud rates are used: 2560; 5120; 7680; 10,240; and 15,360 bits/sec.

In addition, the local modem measures and displays the following, which are the received data statistics:

ERR: Errors—the number of bits received that did not match the test message.

CRC: Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected.

MPD: Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50.

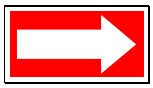
SNR: Signal to Noise Ratio—in dB, where the higher the value the better the acoustic environment.

SPD: Speed—the relative speed in knots between the local and remote modems, where a negative number indicates the modems are moving farther apart and a positive number indicates the modems are moving closer together.

AGC: Automatic Gain Control—a decimal number where the lower the number the less gain, which means a strong input

signal was received. Similarly, the higher the number the more gain, which means a weak input signal was received. The lowest gain indication is 00, and the highest is 95.

CCERR: Corrected Channel Error—Metric 0–14.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Multiple Baud Rate Test command, type ATY followed by the address of the remote modem, and then press Enter.

The remote modem will transmit the 256-byte preset test message at each of the different baud rates, and the local modem will display the received data statistics described above. In addition, depending on the setting of S Register 12, the local modem will display the preset test message which consists of the alphanumeric ASCII character set.

Special Considerations

When using the Multiple Baud Rate Test command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- To optimize the performance and efficiency of the modems, consider reducing the transmit power level of the remote modem with the Remote Power command (AT$Pn,m) and use the Multiple Baud Rate Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's transmitting acoustic baud rate by changing the setting of its S Register 4 with the Remote Baud Rate command (AT$An,m). Again, use the Multiple Baud Rate Test command to verify a low error rate. Similarly, if a high error rate is observed, consider increasing the transmit power level or decreasing the transmitting acoustic baud rate, or both.

Remote Power AT$Pn,m

Syntax

AT$Pn,m [Enter]

Definition

The Remote Power command sets the transmit power level of the remote modem at address n to level m. The range of settings for m is from 01 to 08 for a range of 0 dB to -21 dB of attenuation in -3 dB steps, where 0 dB is the maximum transmit power level and -21 dB is the minimum transmit power level as follows:

01: -21 dB (minimum power level)

02: -18 dB

03: -15 dB

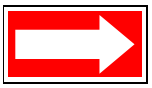
04: -12 dB

05: -09 dB

06: -06 dB

07: -03 dB

08: 00 dB (maximum power level)



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Power command, type AT$P followed by the address of the remote modem, a comma character (,), and the value of m as determined by the required transmit power level, and then press Enter.

The remote modem will set its transmit power level, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Power command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

Remote Baud Rate AT$An,m

Syntax

AT$An,m [Enter]

Definition

The Remote Baud Rate command sets the transmitting acoustic baud rate of the remote modem at address n to m. The range of settings for m is from 02 to 13 as follows:

02: 140 bits/sec MFSK repeated four times with rate 1/2 convolutional coding and 25-ms multipath guard period

03: 300 bits/sec MFSK repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period

04: 600 bits/sec MFSK with rate 1/2 convolutional coding and 25-ms multipath guard period

05: 800 bits/sec MFSK with rate 1/2 convolutional coding and 12.5-ms multipath guard period

06: 1066 bits/sec MFSK with rate 1/2 convolutional coding and 3.125-ms multipath guard period

07: 1200 bits/sec MFSK with rate 1/2 convolutional coding

08: 2400 bits/sec MFSK

09: 2560 bits/sec PSK, with rate 1/2 convolutional coding

10: 5120 bits/sec PSK, with rate 1/2 convolutional coding

11: 7680 bits/sec PSK, with rate 1/2 convolutional coding

12: 10,240 bits/sec PSK

13: 15,360 bits/sec PSK

NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Baud Rate command, type AT$A followed by the address of the remote modem, a comma character (,), and the value of m as determined by the required acoustic baud rate, and then press Enter.

The remote modem will set its transmitting acoustic baud rate, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Power command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Baud Rate command sets S Register 4 of the remote modem to the selected value.
- Settings 09–13 are available for an ATM-890 Series Acoustic Telemetry Modem only.

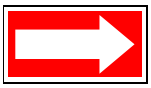
Read Register ATSn?

Syntax

ATSn? [Enter] or ATS? [Enter]

Definition

The Read Register command causes the local modem to display the setting of its S Register n, or if the S Register number is not specified, the settings of all its S Registers.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Read Register command, type ATS and the number of the S Register that is to be read, followed by a question mark (?). Or type ATS? to read all the S Registers, and then press Enter.

The local modem will display its S Register setting or settings. An example that uses the Read Register command is shown in Figure 6-2, where all the S Registers were displayed by entering ATS?

Special Considerations

The S Register settings can be interpreted from Table 7-1 on page 7-2, which includes page references to where detailed descriptions are provided.

```
>ATS?

Local Registers
S00=042  S01=001  S02=000  S03=001  S04=005  S05=000  S06=008
S07=015  S08=060  S09=000  S10=255  S11=001  S12=000  S13=002
S14=001  S15=000  S16=000  S17=001  S18=000  S19=000  S20=000
>
```

Figure 6-2 Read Register Command and Resulting Display

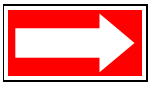
Read Remote Registers AT$Sn

Syntax

AT$Sn [Enter]

Definition

The Read Remote Registers command causes the local modem to display the S Register settings of the remote modem at address n.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Read Remote Registers command, type AT$S followed by the address of the remote modem, and then press Enter.

The local modem will display the S Register settings of the remote modem. An example that uses the Read Remote Registers command is shown in Figure 6-3, where the S Register settings of the remote modem with address 1 were displayed by entering AT$S1.

Special Considerations

When using the Read Remote Registers command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The S Register settings can be interpreted from Table 7-1 on page 7-2, which includes page references to where detailed descriptions are provided.

```
>AT$S1

Remote Registers
S00=041  S01=001  S02=000  S03=002  S04=005  S05=000  S06=008
S07=015  S08=060  S09=000  S10=255  S11=000  S12=000  S13=003
S14=000  S15=000  S16=000  S17=001  S18=001  S19=000  S20=000
>
```

Figure 6-3 Read Remote Registers Command and Resulting Display

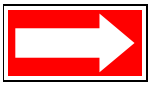
Set Register ATSn=n

Syntax

ATSn=n [Enter]

Definition

The Set Register command sets the local modem's S Register number n to the value entered following "=."



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Set Register command, type ATS and the S Register number to be set, followed by the equal character (=) and the setting desired, and then press Enter.

The local modem will set the S register setting and respond with the message "OK."

Special Considerations

When using the Set Register command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- If at any time it is desired to return the S Register settings to the values they were when the modem was first powered up—and the Write command (AT&W) was *not* used to save the S Register settings as part of the startup configuration—power down the modem, and then power up the modem again.
- Using the Write command (AT&W) after using the Set Register command will save the S Register setting as part of the startup

configuration, which is the S Register settings when the modem is powered up.

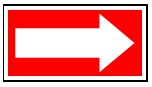
Write AT&W

Syntax

AT&W [Enter]

Definition

The Write command saves the S Register settings of the local modem as the new startup configuration.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Write command, type AT&W, and then press Enter.

The local modem will save its current S Register settings as the startup configuration, and then respond with the message "Sregisters Stored."

WARNING If power is lost while the Write command is being executed, all the S Register settings will revert to their factory default settings upon power up.

Special Considerations

When using the Write command, take note of the following:

- To display the message "Sregisters Stored" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- When the modem is powered up, the S Registers will be set to their new startup configuration. The S Register settings can again be changed with the Set Register command (ATSn=n), and then saved as the new startup configuration with the Write command.

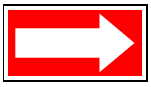
Lowpower State ATL

Syntax

ATL [Enter]

Definition

The Lowpower State command forces the idle time of the local modem to expire, which in turn causes the modem to go into the lowpower state.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Lowpower State command, type ATL, and then press Enter.

The local modem will immediately go into the lowpower state and respond with the message "Lowpower."

WARNING Depending on the setting of S Register 11, the RS-232 driver may be set to turn off whenever the modem is in the lowpower state. Refer to "RS-232 Driver/Flow Control S11" on page 7-25 for information on S Register 11. Therefore, hardware RTS/CTS handshaking *must* be disabled at the host processor when sending the first byte of data to the modem over the serial interface. After the first byte is sent, handshaking can be turned on again or left disabled.

Special Considerations

When using the Lowpower State command, take note of the following:

- To display the message "Lowpower" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.

- The local modem can be awakened by input either from its host processor over the serial interface or from a remote modem over the acoustic link. When awakened, the modem will go into the operating mode determined by the setting of S Register 15.
- When the modem is in the lowpower state, the Device Enable output is turned off. Refer to "Device Enable" on page 6-3 for information on the Device Enable output.

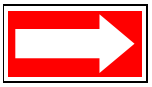
Range ATRn

Syntax

ATRn [Enter]

Definition

The Range command causes the local modem to display the range from the local modem to the remote modem at address n. The displayed range is from 0 to 999.9 meters in increments of tenths of meters, and 1000 to 9999 meters in increments of one meter.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Range command, type ATR followed by the address of the remote modem, and then press Enter.

The local modem will respond by displaying the range in meters to the remote modem.

Special Considerations

When using the Range command, take note of the following:

- The displayed range is the one-way range to the remote modem and is determined acoustically based on a sound speed in seawater of 1500 meters/second.
- To acquire the range to a remote modem, the local modem transmits an interrogation signal to the remote modem, and when the remote modem receives the signal, it responds with a reply. The local modem must receive the reply from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an reply is not received, "Response Not Received" will be displayed.

Remote Doppler Tracking AT$Dn,m

Syntax

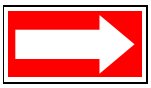
AT$Dn,m [Enter]

Definition

The Remote Doppler Tracking command enables or disables Doppler tracking for the remote modem at address n. The settings for m are 00 and 01 as follows:

00: Disable Doppler tracking.

01: Enable Doppler tracking.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Doppler Tracking command, type AT$D followed by the address of the remote modem, a comma character (,), and the value of m as determined by the required setting.

The remote modem will enable or disable its Doppler tracking, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Doppler Tracking command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

- Doppler correction is effective to 20 knots of relative speed between two modems communicating over the acoustic link.
- Doppler tracking should be enabled if changes in the relative speed between the two modems are expected while transmitting data. However, with Doppler tracking enabled, it is possible to obtain a false Doppler correction in a low signal-to-noise environment.

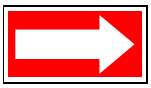
Local Battery Voltage ATV

Syntax

ATV [Enter]

Definition

The Local Battery Voltage command causes the local modem to display the DSP/receiver and transmitter power supply voltages which are supplied from the modem battery pack.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

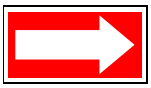
To use the Local Battery Voltage command, type ATV, and then press Enter.

The local modem will display its DSP/receiver and transmitter power supply voltages.

Special Considerations

When using the Local Battery Voltage command, take note of the following:

- The accuracy of the DSP/receiver power supply voltage measurement is ±0.2 V; the transmitter power supply voltage measurement, ±1.0 V.
- While the voltages are being measured, the DSP/receiver power supply is under load and the transmitter power supply is open circuited.



NOTE Refer to Table 8-1 on page 8-3 for the estimated modem battery pack capacity remaining verses the voltage of the transmitter power supply.

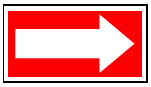
Remote Battery Voltage AT$Vn

Syntax

AT$Vn [Enter]

Definition

The Remote Battery Voltage command causes the local modem to display the DSP/receiver and transmitter power supply voltages of the remote modem at address n. Both supply voltages are supplied from the modem battery pack.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Battery Voltage command, type AT$V followed by the address of the remote modem, and then press Enter.

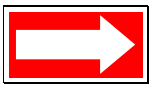
The local modem will display the DSP/receiver and transmitter power supply voltages of the remote modem.

Special Considerations

When using the Remote Battery Voltage command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The accuracy of the DSP/receiver power supply voltage measurement is ±0.2 V; the transmitter power supply voltage measurement, ±1.0 V.

- While the voltages are being measured, the DSP/receiver power supply is under load and the transmitter power supply is open circuited.



NOTE Refer to Table 8-1 on page 8-3 for the estimated modem battery pack capacity remaining verses the voltage of the transmitter power supply.

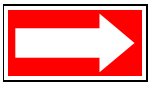
Remote Data Logger Enable AT$BEn

Syntax

AT$BEn [Enter]

Definition

The Remote Data Logger Enable command causes the remote modem at address n to go into Datalogger mode.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Data Logger Enable command, type AT$BE followed by the address of the remote modem, and then press Enter.

The remote modem will go into Datalogger mode, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Data Logger Enable command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Data Logger Enable command sets S Register 15 of the remote modem to 02.

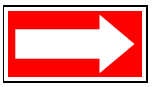
Remote Data Logger Disable AT$BDn

Syntax

AT$BDn [Enter]

Definition

The Remote Data Logger Disable command causes the remote modem at address n to go into Online mode and to go online with the local modem if the remote modem is in Datalogger mode.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Data Logger Disable command, type AT$BD followed by the address of the remote modem, and then press Enter.

The local modem will go online with the remote modem if the remote modem is in Datalogger mode, and then respond with the message "OK."

Special Considerations

When using the Remote Data Logger Disable command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Data Logger Disable command sets S Register 15 of the remote modem to 01.
- The Remote Data Logger Disable command has no effect on the remote modem if the remote modem is not in Datalogger mode.

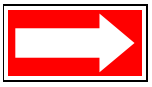
Read Remote Data Logger AT$BTn

Syntax

AT$BTn [Enter]

Definition

The Read Remote Data Logger command causes the local modem to display the contents of the data logger memory of the remote modem at address n.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Read Remote Data Logger command, type AT$BT followed by the address of the remote modem, and then press Enter.

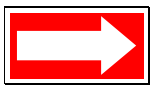
The local modem will display the contents of the remote modem's data logger memory.

Special Considerations

When using the Read Remote Data Logger command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The contents of the remote modem's data logger memory are transmitted at the baud rate set by S Register 4 of the remote modem. If the 704-kbyte data logger memory is full, downloading its contents at a baud rate of 1200 bits/second will take a minimum of 1.3 hours. Slower baud rates will increase the time.

- While the contents of the remote modem's data logger memory are being transmitted, communications with or between other remote modems is not possible.
- While the contents of the remote modem's data logger memory are being transmitted, the remote modem will not accept any input over the serial interface or over the acoustic link.
- The capacity of the remote modem's battery pack must be sufficient to transmit the contents of the remote modem's data logger memory. Refer to "Modem Battery Pack Capacity Calculations" on page 3-3 for information on how to calculate the required modem battery pack capacity.



NOTE The remote modem can also be recovered and the contents of its data logger memory downloaded over its serial interface by using the Output Local Data Logger command (ATBT). Refer to "Output Local Data Logger ATBT" on page 6-69 for instructions.

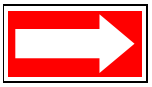
Output Data Logger Block AT$BBn,m

Syntax

AT$BBn,m [Enter]

Definition

The Output Data Logger Block command causes the remote modem at address n to output the contents of block m of its data logger memory over the acoustic link. The range of block numbers is from 0 to 98, and each block contains a maximum of 4 kbytes of data.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Output Data Logger Block command, type AT$BB followed by the address of the remote modem, a comma character (,), and the selected block number of the remote modem's data logger memory.

The remote modem will output the contents of the selected data logger block over the acoustic link.

Special Considerations

When using the Output Data Logger Block command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The contents of the remote modem's data logger block are transmitted at the baud rate set by S Register 4 of the remote modem.

- While the contents of the remote modem's data logger block are being transmitted, communications with or between other remote modems is not possible.
- While the contents of the remote modem's data logger block are being transmitted, the remote modem will not accept any input over the serial interface or over the acoustic link.

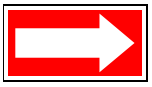
Clear Remote Data Logger AT$BCn

Syntax

AT$BCn [Enter]

Definition

The Clear Remote Data Logger command causes the remote modem at address n to clear the contents of its data logger memory.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Clear Remote Data Logger command, type AT$BC followed by the address of the remote modem, and then press Enter.

The remote modem will clear the contents of its data logger memory, and then the local modem will respond with the message "OK."

Special Considerations

When using the Clear Remote Data Logger command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The time required to clear a remote modem's data logger memory is approximately 20 seconds *plus* the one-way sound travel time for the acoustic command to reach the remote modem. Since sound travels at

about 1500 meters/second in seawater, it will take approximately 22 seconds to clear the data logger memory of a remote modem that is 3000 meters away from the local modem.

- While the contents of the remote modem's data logger memory are being cleared, the remote modem will not accept any input over the serial interface or over the acoustic link.

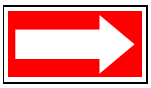
Remote Bytes Stored AT$BNn

Syntax

AT$BNn [Enter]

Definition

The Remote Bytes Stored command causes the local modem to display the number of bytes of data stored in the data logger memory of the remote modem at address n.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Bytes Stored command, type AT$BN followed by the address of the remote modem, and then press Enter.

The local modem will display the number of bytes of data stored in the remote modem's data logger memory.

Special Considerations

When using the Remote Bytes Stored command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- While the number of bytes of data stored in the data logger memory of the remote modem is being transmitted, the remote modem will not accept any input over the serial interface or over the acoustic link.

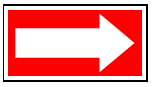
Clear Local Data Logger ATBC

Syntax

ATBC [Enter]

Definition

The Clear Local Data Logger command causes the local modem to clear the contents of its data logger memory.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Clear Local Data Logger command, type ATBC, and then press Enter.

The local modem will clear the contents of its data logger memory. While clearing the memory, the message "20 Seconds to clear..." is displayed followed by "Buffer Cleared" when the memory is cleared.

Special Considerations

When using the Clear Local Data Logger command, take note of the following:

- To display the message "20 Seconds to clear..." and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- The time required to clear the local modem's data logger memory is approximately 20 seconds.
- While the contents of the local modem's data logger memory are being cleared, the local modem will not accept any input over the serial interface or over the acoustic link.

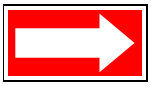
Local Bytes Stored ATBN

Syntax

ATBN [Enter]

Definition

The Local Bytes Stored command causes the local modem to display the number of bytes of data stored in its data logger memory.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Local Bytes Stored command, type ATBN, and then press Enter.

The local modem will display the number of bytes of data stored in its data logger memory.

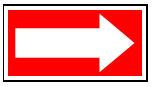
Output Local Data Logger ATBT

Syntax

ATBT [Enter]

Definition

The Output Local Data Logger command causes the local modem to output the contents of its data logger memory over the serial interface.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Output Local Data Logger command, type ATBT.

The local modem will output the contents of its data logger memory over the serial interface.

Special Considerations

When using the Output Local Data Logger command, take note of the following:

- The contents of the local modem's data logger memory do not change when it is output over the serial interface.
- While the contents of the local modem's data logger memory are being output, the local modem will not accept any input over the serial interface or over the acoustic link.

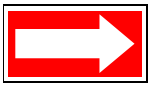
Output Local Page ATBPn

Syntax

ATBPn [Enter]

Definition

The Output Local Page command causes the local modem to output the contents of page n of its data logger memory over the serial interface. The range of page numbers is from 1 to 11, and each page contains a maximum of 64 kbytes of data.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Output Local Page command, type ATBP followed by the selected data logger page number of the local modem's data logger memory.

The local modem will output the contents of the selected data logger page over the serial interface.

Special Considerations

When using the Output Local Page command, take note of the following:

- The contents of the local modem's data logger page do not change when it is output over the serial interface.
- While the contents of the local modem's data logger page are being output, the local modem will not accept any input over the serial interface or over the acoustic link.

AGC Diagnostic ATTNn

Syntax

ATTNn [Enter]

Definition

The AGC Diagnostic command enables or disables the display of the automatic gain control (AGC) output of the local modem. When enabled, the display is updated once a second. The displayed value ranges from -5 dB to 80 dB, where a small value indicates a strong signal is being received, and a large value indicates a weak signal is being received. The displayed value is also an indication of the relative amount of background noise present when there are no modems transmitting.

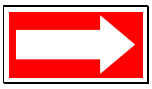
The settings for n are 00 and 01 as follows:

00: Disable display of AGC output

01: Enable display of AGC output.

The following is a rough guide for interpreting the relative amount of background noise when there are *no* modems transmitting:

Greater than 67 dB:	No signal. Indicates a problem with the transducer or preamplifier. Ensure that the transducer is connected.
30–67 dB:	Normal range. Indicates quiet conditions.
15–30 dB:	Some background noise. Although communications over the acoustic link is possible, the range will be reduced.
Less than 15 dB:	Considerable background noise. Communications over the acoustic link will be severely limited.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the AGC Diagnostic command, type ATTN followed by the value of n as determined by the required setting.

The local modem will enable or disable the display of its AGC output. If enabled, the local modem will respond with the message "AGC test ON." If disabled, the local modem will respond with the message "AGC test OFF."

Release Status AT$Tn

Syntax

AT$Tn [Enter]

Definition

The Release Status command causes the SMART Release at address n to transmit its status.The Release Status command can be sent to the release at any time to check its status, even after it has been released, and the status information is displayed.

The local modem displays the following status information:

ARMED:	Displayed when no Release command has been received.
RELEASED and CONFIRMED:	Displayed when the release mechanism has been activated and the release has released from its mooring.
RELEASED and NOT CONFIRMED:	Displayed when the release mechanism has been activated but the release has not released from its mooring.
Tilt Sensor: Tilted:	Displayed when the release is tilted at a angle of greater than 25° from vertical.
Tilt Sensor: OK:	Displayed when the release is not tilted or is tilted at an angle is less than 25° from vertical.
Battery: Low:	Displayed when the battery is low and should be replaced.
Battery: OK:	Displayed when the battery is not low and does not need to be replaced.

NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Release Status command, type AT$T followed by the address of the release, and then press Enter.

The release will transmit its release status and the local modem will display the information described above.

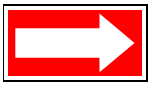
Release AT$Rn,m

Syntax

AT$Rn,m [Enter]

Definition

The Release command causes the SMART Release at address n with release code m to activate its release mechanism.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt (>) displayed. If the modem is not in Command mode, refer to page 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Release Status command, type AT$Rn,m [Enter], where n is the address of the release and m is the release code.

The message "Valid release code-waiting for confirmation..." should be displayed. If the release code is incorrect, the message "Invalid release code" will be displayed, instead. If the correct release code was received, the next message displayed should be "RELEASED and CONFIRMED," which acknowledges that the release mechanism has been activated and that the release has released itself from its mooring. If, instead, the message "RELEASED and NOT CONFIRMED" is displayed, the release mechanism has been activated but the release has not released itself from its mooring.

7 Modem Operating Parameters (S Registers)

The ATM-880 and ATM-890 Series Acoustic Telemetry Modem operating parameters are determined from settings that are stored in 21 nonvolatile memory locations called S Registers, S0–S20. The operating parameters include the serial interface and transmitting acoustic baud rates, the modem address, the idle time, the transmit power level, the forwarding delay, and a number of other parameters that affect the operation of the modem.

The modem operating parameters and their corresponding S Register settings are listed in Table 7-1 on page 7-2. Also listed in the table are the page references to where detailed descriptions of the S Registers and their available settings are provided.

The S Register settings of a local modem can only be made when the modem has been connected to a host processor and is in Command mode. For information on how to set up the modem, refer to "Setting Up the Modems" on page 4-7.

When the modem is powered up, the S Register settings are automatically set to their default settings, which is their startup configuration. Any changes made to the S Register settings can be saved as the new startup configuration with the Write command (AT&W), and the changed settings become the new default settings. In addition, the S Registers can be set to their original factory default startup configuration at any time with the Factory Reset command (AT&F).

To place the modem into Command mode, do one of the following:

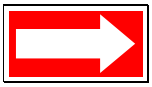
- Enter +++ rapidly.
- If S Register 15 is set to 00, power down and then power up the modem.
- If S Register 15 is set to 00, wait for the idle time to expire.

The modem will go into Command mode and display the command prompt (>).

To make the S Register setting, type ATS and the S Register number to be set, followed by the equal character (=) and the setting desired, and then press Enter.

Table 7-1 ATM-880 and ATM-890 Series Acoustic Telemetry Modem S Registers

S Register	Name	Factory Default Setting	Page
S0	Software Version Number	<Version>	7-3
S1	Doppler Tracking	00	7-5
S2	Packet Retry	00	7-7
S3	Serial Baud Rate	02	7-9
S4	Acoustic Baud Rate	05	7-11
S5	Reserved	***	7-13
S6	Transmit Power Level	08	7-15
S7	Acoustic Response Timeout	15	7-17
S8	Forwarding Delay	60	7-19
S9	Coprocessor Board	(See NOTE below)	7-21
S10	Idle Time	36	7-23
S11	RS-232 Driver/Flow Control	00	7-25
S12	ATX Test Message Length	00	7-27
S13	Verbose Level	01	7-29
S14	Remote Address	00	7-31
S15	Operating Mode	01	7-33
S16	Error Display	01	7-35
S17	Lowpower Wakeup	01	7-37
S18	Modem Address	00	7-39
S19	Reserved	***	7-41
S20	Reserved	***	7-43



NOTE For an ATM-890 Series Acoustic Telemetry Modem, S Register 9 is factory set to 1; for an ATM-880 Series, 0.

Software Version Number S0

Default Setting

<Version> The software version number.

Definition

The setting of S Register 0 is the software version number. For example, a setting of 040 is Version 4.0, and a setting of 041 is Version 4.1.

Available Settings

The setting of S Register 0 is factory set and cannot be changed.

Doppler Tracking S1

Default Setting

00	Doppler tracking is disabled.

Definition

The setting of S Register 1 determines whether Doppler tracking is enabled or disabled. At the start of each transmitted data packet, a check for a Doppler shift is made. If a Doppler shift is detected, a Doppler correction is made. If Doppler tracking is enabled, then Doppler corrections are made continuously throughout the entire packet. If Doppler tracking is disabled, no further Doppler corrections are made.

Available Settings

There are two available settings for S Register 1 as listed below.

00: Disables Doppler tracking.

01: Enables Doppler tracking.

Special Considerations

When setting S Register 1, take note of the following:

- Doppler correction is effective to 20 knots of relative speed between two modems communicating over the acoustic link.
- Doppler tracking should be disabled if the two modems are a fixed distance apart or are moving at a constant relative speed while transmitting data.
- Doppler tracking should be enabled if changes in the relative speed between the two modems are expected while transmitting data. However, with Doppler tracking enabled, it is possible to obtain a false Doppler correction in a low signal-to-noise environment.
- Doppler tracking can be enabled or disabled remotely with the Remote Doppler Tracking command (AT$Dn,m).

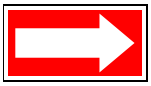
Packet Retry S2

Default Setting

00 Packet retry is disabled.

Definition

The setting of S Register 2 determines whether packet retry is enabled or disabled. When enabled, an acknowledgement is required after transmitting each packet of data, and the data are retransmitted up to two times if errors are detected or if no acknowledgement is received. When disabled, data are transmitted only once.



NOTE As each packet of data contains sixteen 256-byte cells for a total of 4 kbytes, when packet retry is enabled, only the 256-byte cells containing errors are retransmitted.

Available Settings

There are two available settings for S Register 2 as listed below.

00: Disables packet retry.

01: Enables packet retry.

Special Considerations

When setting S Register 2, take note of the following,

- If packet retry is enabled, and if more than 12 kbytes of data are to be transmitted, then hardware RTS/CTS handshaking should be used.
- If packet retry is disabled, and if more than 16 kbytes of data are to be transmitted, then hardware RTS/CTS handshaking should be used.

Serial Baud Rate S3

Default Setting

02	The baud rate of the modem's RS-232/422 serial interface is 9600 baud with no echo.

Definition

The setting of S Register 3 determines the baud rate of a modem's RS-232/422 serial interface.

Available Settings

The available settings for S Register 3 are listed below and include settings with and without echo. If a PC is being used as the host processor, and it is desired to display all of the characters entered from the keyboard, select from the settings with echo only if the PC's terminal program does not have echo capability. If the terminal program has echo capability, select from the settings without echo and turn the program's echo feature on.

05: 1200 baud RS-232 (no echo)	133: 1200 baud RS-232 (w/echo)
00: 2400 baud RS-232 (no echo)	128: 2400 baud RS-232 (w/echo)
01: 4800 baud RS-232 (no echo)	124: 4800 baud RS-232 (w/echo)
02: 9600 baud RS-232 (no echo)	130: 9600 baud RS-232 (w/echo)
13: 1200 baud RS-422 (no echo)	141: 1200 baud RS-422 (w/echo)
08: 2400 baud RS-422 (no echo)	136: 2400 baud RS-422 (w/echo)
09: 4800 baud RS-422 (no echo)	137: 4800 baud RS-422 (w/echo)
10: 9600 baud RS-422 (no echo)	138: 9600 baud RS-422 (w/echo)

WARNING If the baud rate of the modem's serial interface is changed, be sure to set the baud rate of its host processor to the same baud rate, otherwise it will not be possible for the host processor to establish communications with the modem.

Special Considerations

When setting S Register 3, take note of the following:

- When connecting an instrument to the modem, and with S Register 3 set to the default 02 for 9600 baud with no echo, the instrument's serial port should be configured as follows:

  Baud rate: 9600 baud

  Parity: none

  Data bits: 8

  Stop bits: 1

- To have a changed S Register 3 setting take effect, enter the Lowpower State command (ATL) to place the modem into the lowpower state, and then enter the Attention command (AT) to bring the modem out of the lowpower state. Or instead, use the Write command (AT&W) to save the S Register setting as part of the startup configuration, then power down and then power up the modem.
- After changing from RS-232 to RS-422, an RS-422 connection is required to switch back to RS-232. The opposite is true after changing from RS-422 to RS-232.

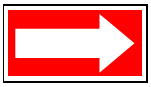
Acoustic Baud Rate S4

Default Setting

05	The transmitting acoustic baud rate of the modem is 800 bits/second, with rate 1/2 convolutional coding and 12.5-ms multipath guard period.

Definition

The setting of S Register 4 determines the transmitting acoustic baud rate, the modulation scheme—MFSK or PSK—and whether any one or more of the three methods for increased reliability are used, which are data redundancy, convolutional coding and multipath guard period.



NOTE The setting of S Register 4 determines the *transmitting* acoustic baud rate only. The receiving modem will receive data and commands from the transmitting modem regardless of the baud rate of the transmitting modem. Therefore the baud rates can be different in each direction for an asymmetrical acoustic link. Only an ATM-890 Series Acoustic Telemetry Modem, however, can receive the baud rates of settings 09–13 below.

Available Settings

The range of settings for S Register 4 is from 02 to 13 as follows:

02: 140 bits/sec MFSK repeated four times with rate 1/2 convolutional coding and 25-ms multipath guard period

03: 300 bits/sec MFSK repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period

04: 600 bits/sec MFSK with rate 1/2 convolutional coding and 25-ms multipath guard period

05: 800 bits/sec MFSK with rate 1/2 convolutional coding and 12.5-ms multipath guard period

06: 1066 bits/sec MFSK with rate 1/2 convolutional coding and 3.125-ms multipath guard period

07: 1200 bits/sec MFSK with rate 1/2 convolutional coding

08: 2400 bits/sec MFSK

09: 2560 bits/sec PSK, with rate 1/2 convolutional coding

10: 5120 bits/sec PSK, with rate 1/2 convolutional coding

11: 7680 bits/sec PSK, with rate 1/2 convolutional coding

12: 10,240 bits/sec PSK

13: 15,360 bits/sec PSK

Special Considerations

When setting S Register 4, take note of the following:

- To maximize the modem battery pack life for the amount of data transmitted, use the highest acoustic baud rate that yields good results.
- When selecting a baud rate that includes a multipath guard period, the selection should include the multipath guard period that is longer than the multipath delay. The multipath delay is measured and displayed as a part of the received data statistics when using the Acoustic Link Test command (ATXn).
- The transmitting acoustic baud rates of settings 09–13 can be received by an ATM-890 Series Acoustic Telemetry Modem only.

Reserved S5

Transmit Power Level S6

Default Setting

08	The transmit power level of the modem is set to 0 dB, which is the highest power level.

Definition

The setting of S Register 6 determines the transmit power level of a modem.

Available Settings

The range of settings for S Register 6 is from 01 to 08 for a range of 0 dB to -21 dB of attenuation in -3 dB steps, where 0 dB is the maximum transmit power level and -21 dB is the minimum transmit power level as follows:

01: -21 dB (minimum transmit power)

02: -18 dB

03: -15 dB

04: -12 dB

05: -09 dB

06: -06 dB

07: -03 dB

08: 00 dB (maximum transmit power)

Special Considerations

When setting S Register 6, take note of the following:

- The transmit power of the modem can be changed remotely with the Remote Power command (AT$Pn,m).
- To maximize the modem battery pack life, use the lowest power setting that yields good communications.

Acoustic Response Timeout S7

Default Setting

15	The local modem will wait 7.5 seconds after sending an acoustic command to a remote modem for the remote modem to acknowledge receipt of the command.

Definition

The setting of S Register 7 determines the acoustic response timeout, which is the time during which a local modem will wait for an acknowledgment to an acoustic command sent to a remote modem. If no acknowledgment is received, the local modem will output the results message “Response Not Received.”

Available Settings

The range of settings for S Register 7 is from 07 to 140, where each increment represents 0.5 seconds for a time range of 3.5 to 70.0 seconds.

Special Considerations

The acoustic response timeout should be increased as the range between a local and remote modem increases. As sound travels at about 1500 meters/sec in seawater, the total time for the sound to travel a two-way distance of 6000 meters, for example, is about 4 seconds. The time it takes for a modem to receive and respond to a command must also be considered. This time, however, will always be approximately 1.75 seconds. Therefore, the default setting of 15 for 7.5 seconds is sufficient for modem ranges equal to or less than 3000 meters, which is equivalent to a two-way distance of 6000 meters.

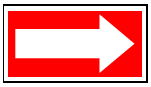
Forwarding Delay S8

Default Setting

60	The modem will transmit the data in one of its four 4-kbyte transmit data buffers, or transfer the data in its 8-kbyte temporary data buffer to the data logger memory when the corresponding buffer is full or 3 seconds after the last data are input, whichever occurs first.

Definition

The setting of S Register 8 determines the forwarding delay of a modem. When a local modem is online with a remote modem, the local modem accumulates data in its four 4-kbyte transmit data buffers. These data are input from its host processor over the serial interface. Immediately after the first transmit data buffer has filled, the 4-kbyte data packet is transmitted. However, if the transmit data buffer does not fill, the data are transmitted anyway a preset time after the last data are input. This time is the forwarding delay. Similarly, when a modem is in Datalogger mode, the data in its 8-kbyte temporary data buffer are transferred to the data logger memory immediately after the buffer has filled, or after the forwarding delay.



NOTE While data are being transmitted from a 4-kbyte transmit data buffer, data can continue to be input to the modem over the serial interface, filling the additional 4-kbyte transmit data buffers.

Available Settings

The range of settings for S Register 8 is from 01 to 100, where each increment represents 0.05 seconds for a time range of 0.05 to 5.0 seconds.

Special Considerations

When setting S Register 8, take note of the following:

- The transmission efficiency is improved if the 4-kbyte transmit data buffer is allowed to fill before transmitting the data.

- Handshaking should be used to ensure there is no loss of data when the 8-kbyte temporary data buffer or all four of the 4-kbyte transmit data buffers are full. This also applies when the modem is transferring data from the temporary data buffer to the data logger memory, transmitting the contents of the data logger memory over the acoustic link, or clearing the contents of data logger memory.

Coprocessor Board S9

Default Setting

00	The Coprocessor Board is disabled or is not installed in the modem.

Definition

The setting of S Register 9 determines whether the Coprocessor Board is installed and enabled.

Available Settings

There are two available settings for S Register 9 as listed below.

00: Disables the Coprocessor Board.

01: Enables the Coprocessor Board.

Special Considerations

When setting S Register 9, take note of the following:

- Only ATM-890 Series Acoustic Telemetry Modems have a Coprocessor Board installed.
- The Coprocessor Board must be enabled for the modem to receive at the high baud rates of 2560–15,360 bits/sec.
- Enabling the Coprocessor Board when the board is not present causes the setting of S Register 9 to reset to 00 automatically.
- When setting S Register 9 to 01, the modem will respond with the message "coprocessor ver x.x" if the Coprocessor Board is installed and fully operational.
- When setting S Register 9 to 01, the modem will respond with the message "coprocessor error" if the Coprocessor Board is not installed or is installed and not fully operational.

Idle Time S10

Default Setting

36	If the local modem does not receive input from its host processor over the serial interface or from a remote modem over the acoustic link in 180 seconds, it will go into the lowpower state.

Definition

The setting of S Register 10 determines the idle time, which is the time after which a modem will go into the lowpower state if there is no input either from its host processor over the serial interface or from a remote modem over the acoustic link.

WARNING Depending on the setting of S Register 11, the RS-232 driver may be set to turn off whenever the modem is in the lowpower state. Refer to "RS-232 Driver/Flow Control S11" on page 7-25 for information on S Register 11. Therefore, hardware RTS/CTS handshaking *must* be disabled at the host processor when sending the first byte of data to the modem over the serial interface. After the first byte is sent, handshaking can be turned on again or left disabled.

Available Settings

The range of settings for S Register 10 is from 01 to 60, where each increment represents 5 seconds for a time range of 5 to 300 seconds. In addition, 00 sets the idle time to 2 seconds and 255 prevents the modem from going into the lowpower state indefinitely.

Special Considerations

When setting S Register 10, take note of the following:

- If a remote modem will be accessed once a day to retrieve a small amount of data, the idle time should be set relatively short. If there will be more frequent and more interactive sessions, the idle time should be set relatively long to avoid the need to frequently reawaken the modem from its lowpower state.

- When a modem is not being powered by batteries, as is typically the case for an ATM-891 Deck Box, the idle time should be set long, or indefinite. This improves operating efficiency, as the modem never has to be reawakened from its lowpower state.

RS-232 Driver/Flow Control S11

Default Setting

00 There is no handshaking.

Definition

The setting of S Register 11 determines whether the RS-232 driver is turned off or left on when a modem is in the lowpower state. Turning off the driver conserves battery power. The setting also determines whether hardware RTS/CTS handshaking or software XON/XOFF handshaking is used for flow control, or if no handshaking is used.

WARNING A setting of 01 will turn off the RS-232 driver whenever the modem is in the lowpower state. Therefore, hardware RTS/CTS handshaking *must* be disabled at the host processor when sending the first byte of data to the modem over the serial interface. After the first byte is sent, handshaking can be turned on again or left disabled.

Available Settings

There are three available settings for S Register 11 as listed below.

00: Selects no handshaking and turns off the RS-232 driver when the modem is in the lowpower state.

01: Selects hardware RTS/CTS handshaking and turns off the RS-232 driver when the modem is in the lowpower state. Therefore when the modem is in the lowpower state, there is no handshaking.

02: Selects hardware RTS/CTS handshaking and leaves the RS-232 driver turned on when the modem is in the lowpower state. However, the modem draws an additional 2 mA of current which shortens the modem battery pack life.

03: Selects software XON/XOFF handshaking and turns off the RS-232 driver when the modem is in the lowpower state.

ATX Test Message Length S12

Default Setting

00	When the local modem transmits the Acoustic Link Test command (ATXn) to a remote modem, the remote modem will transmit an 8-byte preset test message, and when the message is received by the local modem, it will not be displayed.

Definition

The setting of S Register 12 determines which of 8 preset test messages a remote modem will be commanded to transmit when it receives the Acoustic Link Test command (ATXn) from the local modem. The setting also determines whether the preset message, when received by the local modem, is displayed.

Available Settings

There are 16 available settings for S Register 12 as listed below.

00: 8-byte message (no display)	128: 8-byte message (w/display)
01: 32-byte message (no display)	129: 32-byte message (w/display)
02: 128-byte message (no display)	130: 128-byte message (w/display)
03: 256-byte message (no display)	131: 256-byte message (w/display)
04: 512-byte message (no display)	132: 512-byte message (w/display)
05: 1024-byte message (no display)	133: 1024-byte message (w/display)
06: 2048-byte message (no display)	134: 2048-byte message (w/display)
07: 4096-byte message (no display)	135: 4096-byte message (w/display)

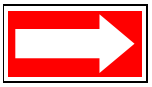
Verbose Level S13

Default Setting

01	The verbose level of the modem is set to the level which displays data and some diagnostic messages.

Definition

The setting of S Register 13 determines whether only data, or data and other information, when received by the local modem, are displayed.



NOTE Should a fatal error occur, it is displayed regardless of the setting of S Register 13.

Available Settings

The range of settings for S Register 13 is from 00 to 04 as listed below.

00: Only data are displayed.

01: Data and some diagnostic messages are displayed.

02: Data, most diagnostic messages, and received data statistics are displayed.

03: Data, additional diagnostic messages, and received data statistics are displayed.

04: For factory use only.

With a setting of 02 or higher, data, along with received data statistics, are displayed in the following general format:

DATA(# of bytes of data)**: .....** the actual data **.....**
.....
.....

Source:xx **Destination:**xx
CRC: Pass/Fail **MPD:**x.x **SNR:**xx.x **SPD:**+/-xx.x **AGC:**x.x **CCERR:**xx

The received data statistics shown above are composed of the following:

Source: The address of the modem that transmitted the data.

Destination: The address of the modem that received the data.

CRC: Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected.

MPD: Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50.

SNR: Signal to Noise Ratio—in dB, where the higher the value the better the acoustic environment.

SPD: Speed—the relative speed in knots between the local and remote modems, where a negative number indicates the modems are moving farther apart and a positive number indicates the modems are moving closer together.

AGC: Automatic Gain Control—a decimal number where the lower the number the less gain, which means a strong input signal was received. Similarly, the higher the number the more gain, which means a weak input signal was received. The lowest gain indication is 00, and the highest is 95.

CCERR: Corrected Channel Error—Metric 0–14.

Special Considerations

When setting S Register 13, take note of the following:

- When a PC is used as the host processor, S Register 13 should be set to 01.
- When an instrument is used as the host processor, S Register 13 should be set to 00. This will avoid errors that might occur should the instrument be unable to recognize the diagnostic messages or received data statistics.

Remote Address S14

Default Setting

00	The address of the remote modem that the local modem is online with is 00.

Definition

The setting of S Register 14 is the address of the remote modem that the local modem is online with when the local modem is powered up or awakened from the lowpower state. This occurs only if S Register 15 is set to 01.

Available Settings

The range of settings for S Register 14 is from 00 to 99. This provides a total of 100 addresses.

Special Considerations

When setting S Register 14, take note of the following:

- The Dial command (ATDn) sets S Register 14 of the remote modem to the address of the local modem.
- The Dial command (ATDn) sets S Register 14 of the local modem to the address of the remote modem.

Operating Mode S15

Default Setting

01	When the modem is powered up or awakened from the lowpower state, the modem will go into Online mode.

Definition

The setting of S Register 15 determines the operating mode that a modem will go into when it is powered up or when the modem is awakened from the lowpower state.

Available Settings

The range of settings for S Register 15 is from 00 to 02 as listed below.

00: Command mode

01: Online mode

02: Datalogger mode

Error Display S16

Default Setting

01 Data packets containing errors are not displayed.

Definition

The setting of S Register 16 determines whether data packets that contain errors are displayed.

Available Settings

There are two available settings for S Register 16 as listed below.

00: Data packets containing errors are displayed.

01: Data packets containing errors are not displayed.

Lowpower Wakeup S17

Default Setting

01	The lowpower wakeup signal is transmitted at the beginning of every data packet.

Definition

The setting of S Register 17 enables or disables transmission of the lowpower wakeup signal at the beginning of every data packet. The lowpower wakeup signal is a 375-ms long signal that wakes up all the remote modems that are in the lowpower state.

Available Settings

There are two available settings for S Register 15 as listed below.

00: Disables the lowpower wakeup signal.

01: Enables the lowpower wakeup signal.

Special Considerations

When setting S Register 17, take note of the following:

- The lowpower wakeup signal should be disabled only for the transmitting modem, and only if it is known that the receiving modem will never go into the lowpower state. To prevent the receiving modem from going into the lowpower state, set its S Register 10 to 255.
- Disabling the lowpower wakeup signal lengthens the modem battery pack life for the transmitting modem.

Modem Address S18

Default Setting

00	The address of the modem is 00.

Definition

The setting of S Register 18 determines the address of the modem.

Available Settings

The range of settings for S Register 18 is from 00 to 99. This provides a total of 100 addresses.

Special Considerations

When setting S Register 18, take note of the following:

- S Register 18 cannot be changed remotely over the acoustic link, therefore it is important that the correct address be set prior to deploying the modem.
- The same address can be used for more than one modem; however, this may not be desirable in some situations.

Reserved S19

Reserved S20

8 Maintenance and Troubleshooting

This section encompasses the recommended care and maintenance procedures for the subsea modem components of the ATM-880 and ATM-890 Series Acoustic Telemetry Modems. Adherence to these procedures will help to ensure many years of continuous, reliable performance from the modems. In addition, a troubleshooting guide is provided which will assist in isolating and correcting some of the basic operational problems that could occur during setup or deployment.

The care and maintenance of the modems involve two areas: general cleaning and inspection, and changing the modem battery packs. The tools required to perform these tasks include the following:

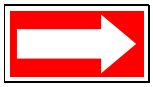
- ***9/64 Allen wrench***
- ***5/32 Allen wrench***
- ***Phillips head screwdriver***
- ***Flat head screwdriver***
- ***Wire cutters***
- ***Silicone O-ring lubricant***
- ***Alcohol wipes***
- ***Paper towels***

General Cleaning and Inspection

After retrieving a subsea modem, clean and inspect the modem as follows:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-4 on page 4-6 for the location of the modem on/off switch.
2. Using a cloth or paper towel dry the modem thoroughly.
3. Unplug the cable from the POWER/SERIAL connector on the modem, inspect and clean the cable, and then clean the connector with an alcohol wipe.

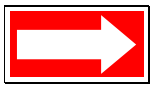
4. Lubricate the POWER/SERIAL connector pins with a light coat of silicone lubricant and install the dummy connector supplied with the modem.



NOTE Be especially careful not to get any lubricant on the face of the transducer as this will severely degrade its performance.

For the ATM-885R and ATM-887R Acoustic Telemetry Modems, perform all the steps listed below. For the ATM-885 and ATM-887 modems, go to Step 7.

5. Unplug the remote transducer cable from both the remote transducer connector on the modem and the connector on the remote transducer, inspect and clean the cable, and then clean the connectors with an alcohol wipe.
6. Lubricate the connector pins on both the remote transducer connector on the modem and the connector on the remote transducer with a light coat of silicone lubricant and install the dummy connectors supplied.
7. Wash down the modem with clean, *fresh* water and remove any debris that may have become attached to the housing.
8. Clean the transducer with a mild, non-abrasive detergent, being careful to remove any buildup. After cleaning, spray the transducer again with fresh water.



NOTE Do not use an ammonia-based cleaner such as a glass cleaner to clean the transducer.

9. Carefully inspect the transducer for any signs of damage.

Changing the Modem Battery Packs

The subsea modems, except for the ATM-888 Acoustic Telemetry Modem, have an internal battery pack which will occasionally require changing. To change the modem battery pack, the modem requires disassembly, and the procedures for disassembling the ATM-885 and ATM-885R Acoustic Telemetry Modems are different than those for the ATM-887 and ATM-887R Acoustic Telemetry Modems.

Checking the Modem Battery Pack

The capacity of the modem battery pack can be estimated by measuring the battery pack voltage—either open circuited or under load. A more meaningful measurement, however, is obtained when the battery pack is under load. To check the modem battery pack after removing it from a modem, connect a 150-ohm, 3-watt resistor across the battery pack terminals, measure the voltage across the load resistor with a digital multimeter, and refer to Table 8-1 to determine the battery pack capacity.

Table 8-1 Modem Battery Pack Capacity vs. Voltage

Voltage Under 150-Ohm Load (volts)	Capacity Remaining (%)
20	100
18	95
17	75
16	50
15	25
14	10
13	1

Changing the ATM-885 or ATM-885R Modem Battery Pack

For either the ATM-885 or the ATM-885R Acoustic Telemetry Modem, both end caps require removal when changing the modem battery pack. First, the POWER/SERIAL connector end cap must be removed, and then the transducer end cap for an ATM-885 Acoustic Telemetry Modem or the remote transducer connector end cap for an ATM-885R Acoustic Telemetry Modem.

To change the modem battery pack for an ATM-885 or ATM-885R:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-4 on page 4-6 for the location of the modem on/off switch.
2. For an ATM-885 Acoustic Telemetry Modem only, use a 5/32 Allen wrench to remove the four socket head screws and four washers that attach the transducer guard to the housing clamp and remove the guard.

3. With the modem on its side and resting on a flat surface, use a 9/64 Allen wrench to remove the three socket head screws that attach the POWER/SERIAL connector end cap to the housing.
4. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.
5. Disconnect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap.
6. Using a 9/64 Allen wrench remove the three socket head screws that attach the transducer end cap for an ATM-885 Acoustic Telemetry Modem, or the remote transducer connector end cap for an ATM-885R Acoustic Telemetry Modem.
7. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling. When clear of the housing, continue to pull the end cap out while pushing on the battery pack from the other end of the housing. Pull the end cap out far enough to access the 5-pin power connector on the top of the circuit board.
8. Disconnect the 5-pin power connector.
9. Cut the wire tie with wire cutters and remove the 10-pin serial cable connector by first pressing down on the locking sleeve tab to unlock it, then slide the locking sleeve along the wire harness out of the way, grab the cable connector, and gently pull to disconnect it.
10. Place the end cap assembly on a clean, flat surface.
11. Remove the modem battery pack by first pushing it out from the POWER/SERIAL connector end cap end and then removing it from the opposite end.
12. Inspect the O-rings on both end caps. They should be free of any scratches, nicks or dirt. Inspect the O-ring surfaces on the housing. They should also be free of any scratches, nicks or dirt.

    Wipe the O-rings clean with an alcohol wipe and apply a light coat of silicone lubricant. Replace any O-ring that appears cracked or nicked.

    When replacing an O-ring, first clean the O-ring surface on the housing with a clean, lint-free cloth or paper towel, and then apply a thin coat of silicone lubricant to the new O-ring before installing it onto the end cap.
13. Insert the new modem battery pack into the housing from the transducer end cap end for an ATM-885 Acoustic Telemetry Modem, or from the remote transducer connector end cap end for an ATM-885R Acoustic Telemetry Modem, and slide the battery pack into the housing about half way.

14. Connect the 10-pin serial connector to the circuit board and secure it with the locking sleeve.
15. Connect the 5-pin serial connector to the circuit board.
16. Use a wire tie to secure the wire harness to the wire tie block. Slide the chassis and the battery pack together into the housing, and then press the end cap into the housing, being careful not to pinch the wires.
17. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.
18. Connect the in-line connector that connects the modem battery pack to the connector on the POWER/SERIAL connector end cap, and then press the end cap into the housing, being careful not to pinch the wires.
19. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.
20. For an ATM-885 Acoustic Telemetry Modem only, install and secure the transducer guard using the four hex head screws.

Changing the ATM-887 or ATM-887R Modem Battery Pack

For either the ATM-887 or the ATM-887R Acoustic Telemetry Modem, both end caps require removal when changing the modem battery pack. First, the transducer end cap for an ATM-887 Acoustic Telemetry Modem or the top end cap for an ATM-887R Acoustic Telemetry Modem must be removed, and then the POWER/SERIAL connector end cap.

To change the modem battery pack for an ATM-887 or ATM-887R:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-4 on page 4-6 for the location of the modem on/off switch.
2. Using a flat head screwdriver loosen the stainless steel band clamp on the transducer end cap for an ATM-887 Acoustic Telemetry Modem or the remote transducer connector end cap for an ATM-887R Acoustic Telemetry Modem. Slide the band clamp down along the housing out of the way.
3. With the modem on its side and resting on a flat surface, carefully pull the end cap straight out from the housing, far enough to access the connectors on the circuit board. If required, rotate the end cap slightly while pulling.

4. Disconnect the 5-pin power and 10-pin serial cable connectors that connect to the circuit board and set the end cap assembly aside.
5. Using a flat head screwdriver loosen the stainless steel band clamp on the POWER/SERIAL connector end cap. Slide the clamp down along the housing and out of the way.
6. Carefully pull the end cap straight out, completely removing it and the battery tray with the installed batteries from the housing. If required, rotate the end cap slightly while pulling.
7. Remove the tape that holds the batteries in the battery tray.
8. One at a time remove the two batteries from the battery tray, and then remove the tape that secures the in-line connectors and disconnect the packs.
9. Connect the in-line connectors of the new batteries and secure the connectors with tape.
10. Install the batteries into the battery tray one at a time, label side out, tucking the battery wires out of the way, one between the battery pack and the battery tray bulkhead, and the other between the two packs.
11. Tape the batteries in place using packing or electrical tape.
12. Inspect the O-rings on both end caps. They should be free of any scratches, nicks or dirt. Inspect the O-ring surfaces on the housing. They should also be free of any scratches, nicks or dirt.

    Wipe the O-rings clean with an alcohol wipe and apply a light coat of silicone lubricant. Replace any O-ring that appears cracked or nicked.

    When replacing an O-ring, first clean the O-ring surface on the housing with a clean, lint-free cloth or paper towel, and then apply a thin coat of silicone lubricant to the new O-ring before installing it onto the end cap.
13. Feed the wire harness through the housing and slide the battery pack into the housing until the gland seal O-ring on the end cap is against the housing. Be careful not to scrape the O-ring surface on the inside wall of the housing.
14. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
15. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

16. Connect the 5-pin power and 10-pin serial cable connectors to the circuit board.
17. Slide the chassis into the housing until the gland seal O-ring on the end cap is against the housing, being careful not to scrape the O-ring surface on the inside wall of the housing
18. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
19. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

Troubleshooting

If during the setup or deployment of the modems, an ATM-880 or ATM-890 Series Acoustic Telemetry Modem does not appear to be functioning properly, use the troubleshooting guide in this section for assistance. The troubleshooting guide will help to quickly isolate some basic operational problems that could occur. However, should further help be required, contact Benthos directly. Refer to "Customer Service" on page vi for information on how to contact Benthos.

The troubleshooting guide includes a list of symptoms along with a list of recommended checks designed to lead to the most likely cause.

When turning on the ATM-891 Deck Box, the POWER ON LED does not illuminate.

A. If AC power is being used to power the deck box, verify that the AC power cable is connected to the deck box and is plugged into a 100–120 VAC, 50–60 Hz or 200–240 VAC, 50–60 Hz power source.

B. If DC power is being used to power the deck box, verify that the DC power cable is connected to the deck box, and is plugged into a 21–28 VDC power supply.

C. Verify that the AC or DC voltage of the power source is correct.

D. Check the fuse.

If the fuse is blown, replace it with a 4-amp slo-blow type.

E. If AC power is being used to power the deck box, check the ON/OFF circuit breaker/rocker switch to see if the circuit breaker has tripped.

There is no banner message displayed on the monitor of the host PC connected to a modem when the modem is switched on.

A. Verify that the host PC serial port is configured correctly, with the correct baud rate, parity, number of data bits, and number of stop bits. Refer to "Setting up the Host Processor" on page 4-15.

B. Verify that the terminal program communications software is running.

C. Verify that the verbose level as determined from S Register 13 is set to 01, 02 or 03. Refer to "Verbose Level S13" on page 7-29 for information on S Register 13.

D. If the modem has an internal battery pack, verify that it has not been depleted.

E. Verify that the RS-232 serial cable is configured correctly and that it is connected to the correct serial port on the host PC. Refer to "Setting Up the Modems" on page 4-7.

The monitor of the host PC connected to a subsea modem displays the banner message when the modem is switched on, but there is no displayed response to commands entered from the keyboard of the host PC.

A. Verify that the terminal program communications software echo feature, if it has one, is turned on.

B. If the terminal program communications software does not have an echo feature, enter the Read Register command (ATSn?), where n is 3, to verify that the baud rate selection, as determined by the setting of S Register 3, is one with echo on. Refer to "Serial Baud Rate S3" on page 7-9 for information on S Register 3.

There is serial communications with the local modem but no transmissions can be heard from the local modem after entering a command that requires the modem to transmit an acoustic command.

A. If the ATM-891 Deck Box is the local modem, increase the volume setting using the VOLUME control.

B. If the local modem is an ATM-891 Deck Box, or an ATM-885R or ATM-887R Acoustic Telemetry Modem, check the transducer connections.

C. Verify that the verbose level as determined from S Register 13 is set to 01, 02, or 03. Refer to "Verbose Level S13" on page 7-29 for information on S Register 13.

With the verbose level set to 01 or higher, errors—if any—will be displayed which will help in isolating the problem.

D. Verify that the command is being sent correctly. Refer to Table 6-1 on page 6-12 for a list of the available commands and their syntax.

E. If the modem is a subsea modem, verify that the modem battery pack has not been depleted.

After entering a command that requires the modem to transmit an acoustic command, transmissions can be heard from the local modem, but there are no responses heard from the remote modem.

A. Verify that the correct address for the remote modem is being entered when entering the command.

B. Verify that the correct modem transducers have been selected and that they are oriented correctly. Refer to "Remote Transducer Selection" on page 3-1 for information on making the optimum selection.

C. Verify that the remote modem is switched on.

For a subsea modem deployed in deep water, water pressure will push the on/off switch in, turning on the modem. If deployed in shallow water, it may be necessary to retrieve the modem to verify that it is turned on.

D. If the remote modem is a subsea modem, verify that the modem battery pack has not been depleted.

9 Drawings

This section includes the outline and wiring drawings for the ATM-880 and ATM-890 Series Acoustic Telemetry Modems, including the surface and subsea modems, the modem board sets, and the remote transducers. Refer to these drawings when setting up and installing the modems.

Surface Modems

B-270-54	Outline, ATM-891 Deck Box

Subsea Modems

A875-08446	Outline, ATM-885 Modem
A875-08676	Outline, ATM-885R Modem
B845-08339	Outline, ATM-887 Modem
B877-08723	Outline, ATM-887R Modem

Modem Board Sets

B875-08659	Outline, ATM-885, PCB, OEM Board Set (Sheets 1 & 2)
B875-08693	Outline, ATM-885R, PCB, OEM Board Set

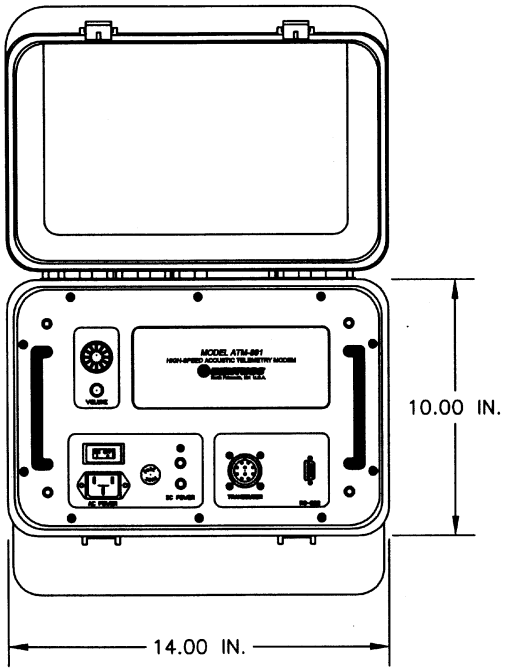
Remote Transducers

A875-08689	Outline, ATM-408 Transducer (LF)
B421-08716	Outline, ATM-421 Transducer (LF)
A875-09248	Outline, ATM-421 Transducer (MF)

Wiring Diagrams

When viewing this manual in Adobe Acrobat Reader, clicking a drawing number below will open the drawing in Adobe Acrobat Reader.

C875-08675	Wiring Diagram, ATM-87XR
D-270-22	Wiring Diagram, ATM-891



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	A					
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	A					
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DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR

TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: B270054A.DWG

BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.

TITLE: OUTLINE, ATM-891 DECKBOX

DRAWING NUMBER: B-270-54
REVISION: A
DATE: 09/05/02
SCALE: NONE
SHEET 1 OF 1

DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR
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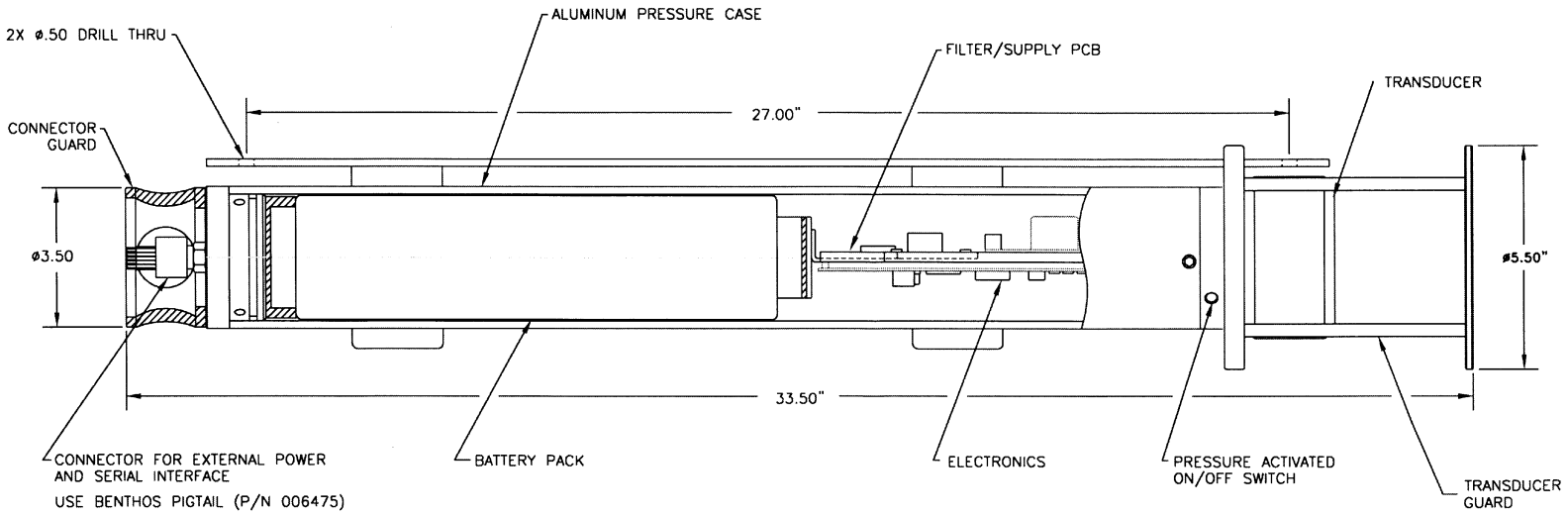
12/05/01	A	8896	UPDATED DRAWING	GC		



TOLERANCES EXCEPT AS NOTED DECIMAL .X=±.015 .XX=±.010 .XXX ±.005 FRACTIONAL ±1/64 Hole size &location ±1/32 General ANGULAR ±1° BREAK SHARP EDGES EXCEPT AS NOTED R.010 63 ALL surfaces except as noted	CONFIDENTIAL This document and the information contained therein is proprietary and confidential to Benthos, Inc. and may not be used, reproduced, or disclosed without the express written consent of Benthos. DRAWN BY: DMP CHECKED BY: PP APPROVED BY: RDS DRAWING FILE NAME: A87508446A.DWG	BENTHOS 49 Edgerton Drive North Falmouth, MA. 02556 U.S.A. TITLE: OUTLINE, ATM–885 MODEM DRAWING NUMBER: A875–08446 REVISION A DATE: 07/29/97 SCALE: 1/2 SHEET 1 OF 1

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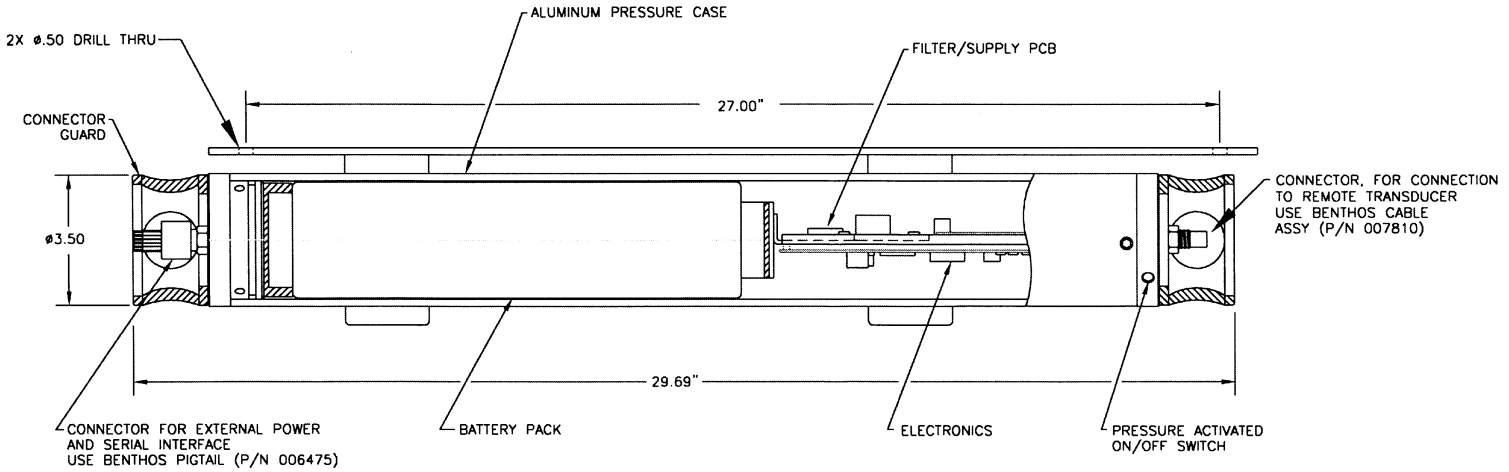
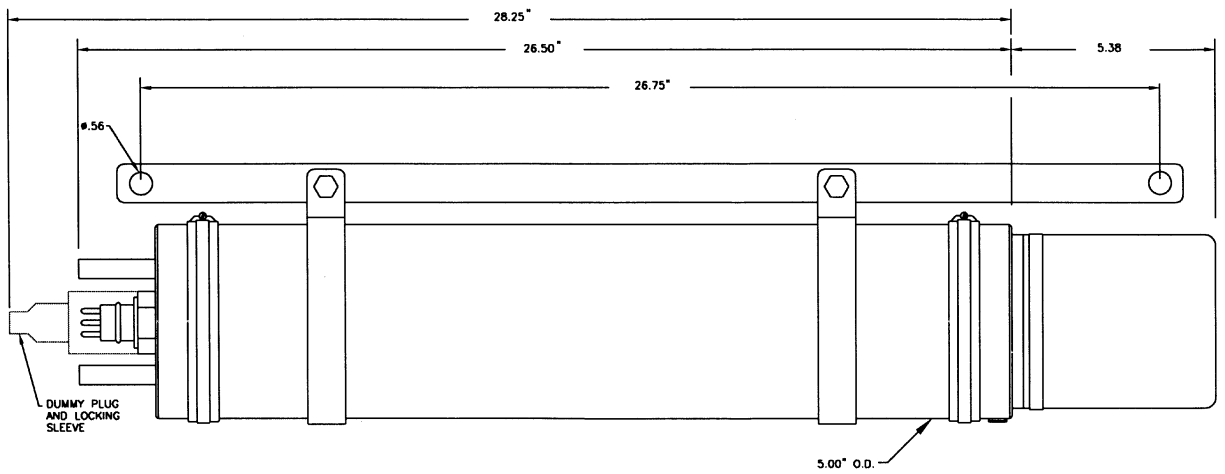
12/05/01	A	8896	UPDATED DRAWING	GC		



TOLERANCES EXCEPT AS NOTED DECIMAL .X=±.015 .XX=±.010 .XXX ±.005 FRACTIONAL ±1/64 Hole size &location ±1/32 General ANGULAR ±1° BREAK SHARP EDGES EXCEPT AS NOTED R.010 63 ALL surfaces except as noted	CONFIDENTIAL This document and the information contained therein is proprietary and confidential to Benthos, Inc. and may not be used, reproduced, or disclosed without the express written consent of Benthos. DRAWN BY: DMP CHECKED BY: PP APPROVED BY: RDS DRAWING FILE NAME: A87508676A.DWG	BENTHOS 49 Edgerton Drive North Falmouth, MA. 02556 U.S.A. TITLE: OUTLINE, ATM–885R MODEM DRAWING NUMBER: A875–08676 REVISION: A DATE: 7/29/97 SCALE: NTS SHEET 1 OF 1



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01/10/01	–	8281	UP-DATED TO BENTHOS FORMAT	GC	PP	RDS
DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR

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FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.

TITLE: OUTLINE, ATM-887

DRAWING NUMBER: B845-08339
REVISION: A
DATE: 4/6/96
SCALE: NTS
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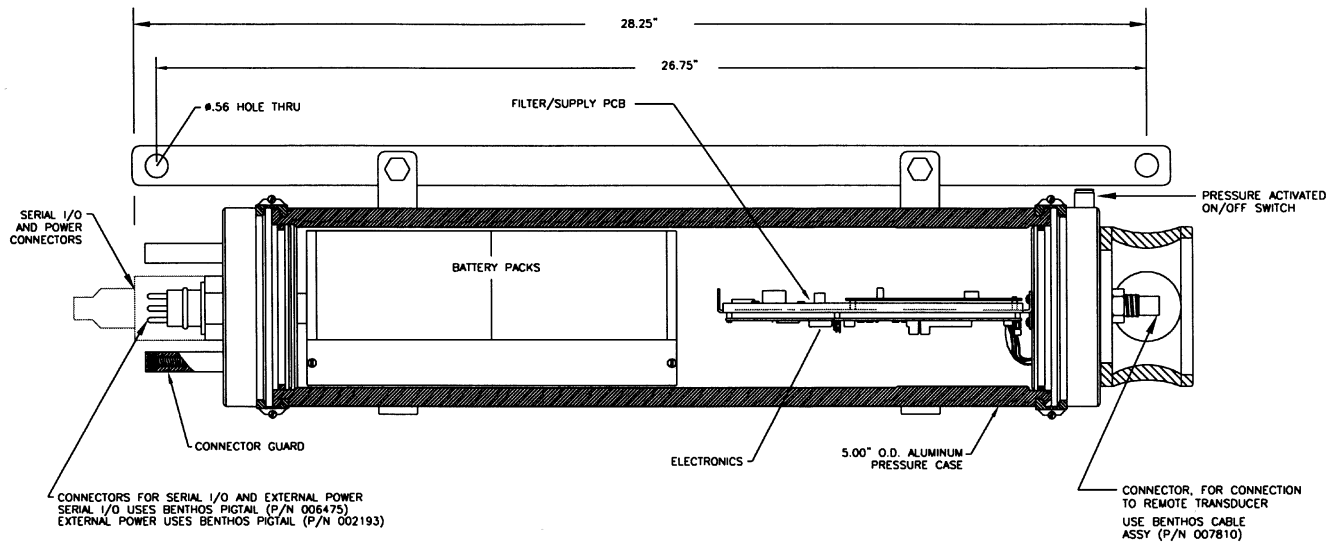

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7/9/99	△A	--	CORRECTED CONNECTED VIEW	SJN		

TOLERANCES EXCEPT AS NOTED
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FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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BENTHOS
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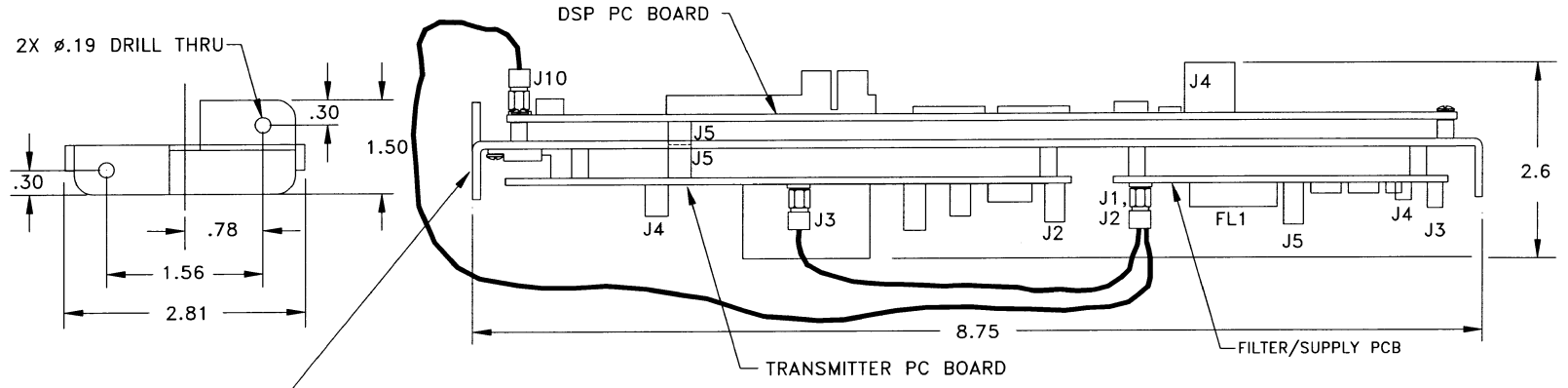
North Falmouth, MA. 02556 U.S.A.

TITLE: OUTLINE, ATM-887R

DRAWING NUMBER: B877-08723 REVISION: B

DATE: 4/2/78 SCALE: NTS SHEET 1 OF 1



TRANSMITTER PCB CONNECTIONS

J2 – TRANSDUCER CONNECTION
J3 – PREAMP OUTPUT, TO FILTER BOARD
J4 – POWER INPUT FROM FILTER BOARD

FILTER SUPPLY PCB CONNECTIONS

J1 – SIGNAL IN
J2 – SIGNAL OUT TO DSP
J3 – BATTERY OR EXTERNAL POWER
J4 – ON/OFF SWITCH (CUSTOMER SUPPLIED)
J5 – POWER OUT TO OTHER BOARDS

MFSK DSP PCB CONNECTIONS

J4 – SERIAL INTERFACE
J10 – RECEIVE INPUT FROM FILTER

04/02/04	D		ADD J5 TO DSP & XMITTER	TMO		
07/16/03	C	9676	ADD NEW P/N FOR BAND C OMNI	DFM		
10/25/02	B	9345	OUTLINE DWG FOR MANUAL	TJA	KS	RDS
12/05/01	A	8896	UPDATE DRAWING	GC	JC	RDS
01/05/01	–	8281	UP-DATED TO BENTHOS FORMAT	GC	PP	RDS
DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR

TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.

TITLE: OUTLINE, ATM-885, PCB, OEM BOARD SET

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REVISION: D
DATE: 2/6/98
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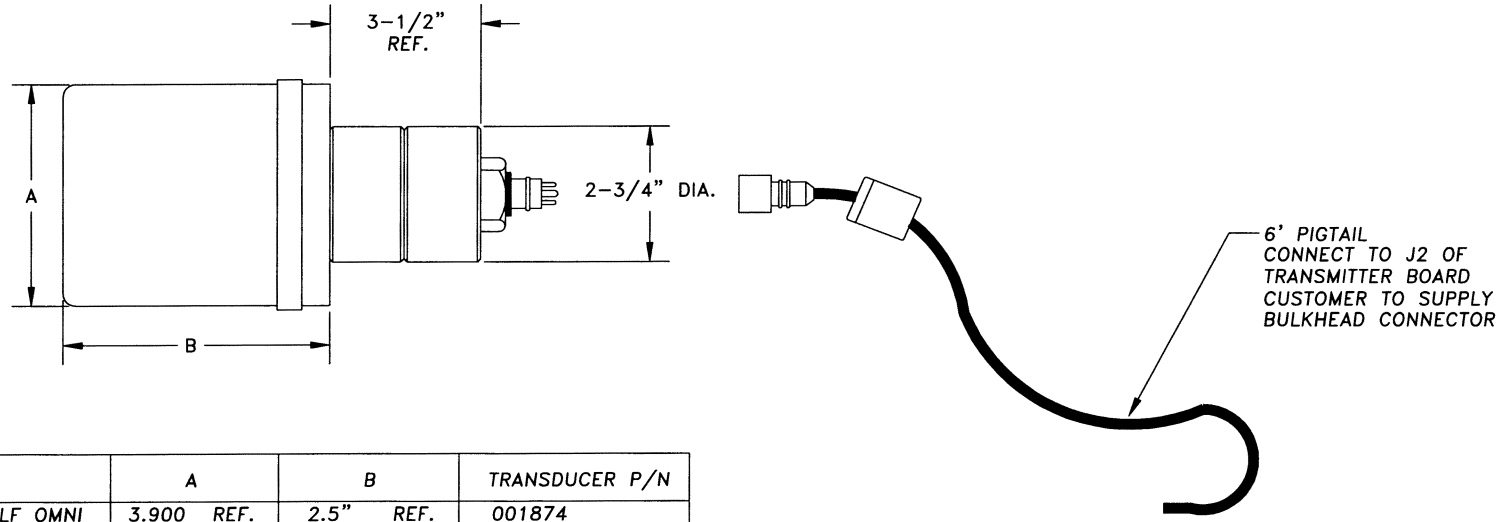
SHEET 1 OF 2



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LF OMNI	3.900 REF.	2.5" REF.	001874
MF OMNI	2.875 REF.	2" REF.	002123
MF DIR	4.500" REF.	5.5" REF.	001496
HF OMNI	2.750 REF.	1.6" REF.	001573
△C BAND C OMNI	2.750 REF.	2.1" REF.	010503

	△						
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DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR	

TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63/ ALL surfaces except as noted

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APPROVED BY: RDS
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49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.

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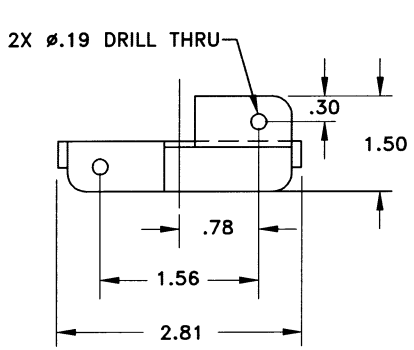
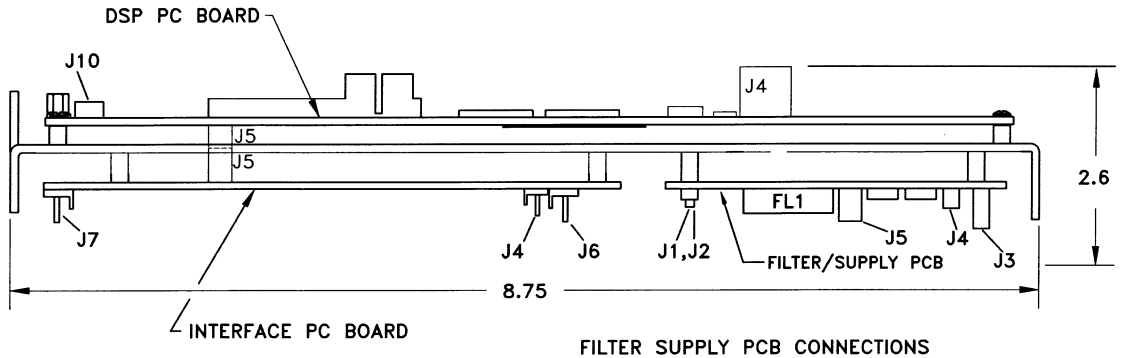
DATE: 2/6/98
SCALE: NTS
SHEET 2 OF 2





FILTER SUPPLY PCB CONNECTIONS

J1 – REMOTE TRANSDUCER
J2 – SIGNAL OUT TO DSP
J3 – BATTERY OR EXTERNAL POWER
J4 – ON/OFF SWITCH (CUSTOMER SUPPLIED)
J5 – POWER OUT TO OTHER BOARDS

INTERFACE PCB CONNECTIONS

J7 – REMOTE TRANSDUCER CONNECTION
J6 – N/C
J4 – POWER FROM FILTER/SUPPLY PCB

MFSK DSP PCB CONNECTIONS

J4 – SERIAL INTERFACE
J10 – RECEIVE INPUT FROM FILTER

DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR
04/07/04	B	----	CONN. CHANGES	TMO		
12/05/01	A	8896	UPDATE DRAWING	GC		
01/06/01	-	8281	UP-DATED TO BENTHOS FORMAT	GC	PP	RDS

TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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DRAWN BY: DMP
CHECKED BY: PP
APPROVED BY: RDS
DRAWING FILE NAME: B875086938.DWG

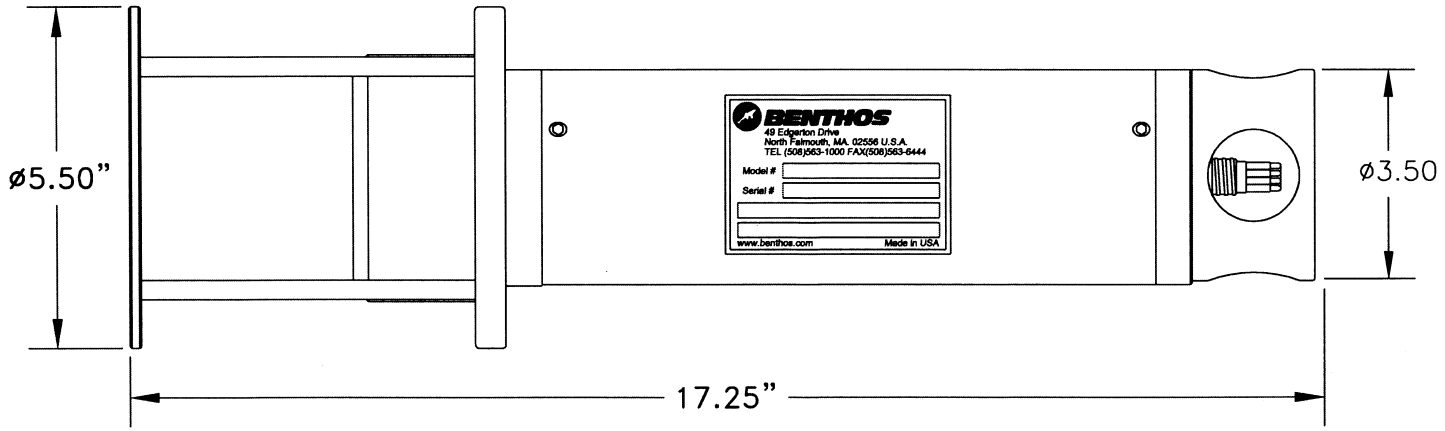
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.

TITLE: OUTLINE, ATM-885R, PCB, OEM BOARD SET

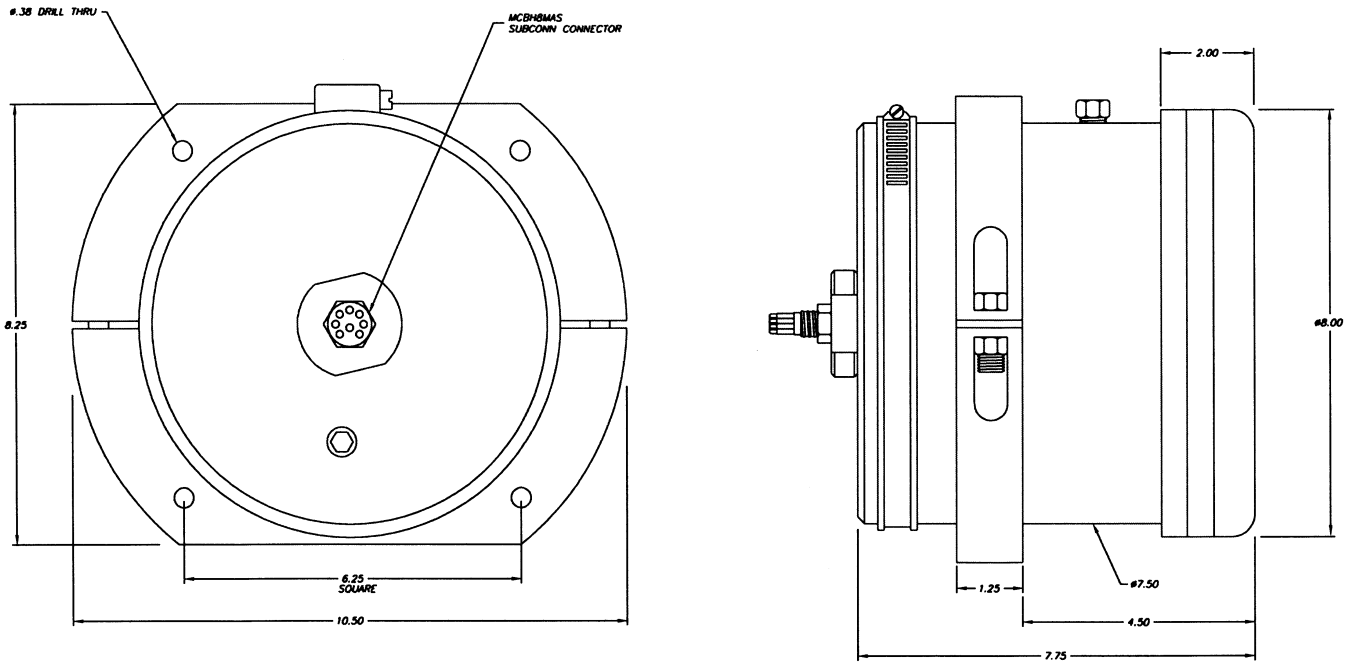
DRAWING NUMBER: B875-08693 REVISION: B

DATE: 3/2/98 SCALE: NTS SHEET 1 OF 1

DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR
01/06/01	–	8281	UP-DATED TO BENTHOS FORMAT	GC		



TOLERANCES EXCEPT AS NOTED DECIMAL .X=±.015 .XX=±.010 .XXX ±.005 FRACTIONAL ±1/64 Hole size &location ±1/32 General ANGULAR ±1° BREAK SHARP EDGES EXCEPT AS NOTED R.010 63 ALL surfaces except as noted	CONFIDENTIAL This document and the information contained therein is proprietary and confidential to Benthos, Inc. and may not be used, reproduced, or disclosed without the express written consent of Benthos. DRAWN BY: DMP CHECKED BY: APPROVED BY: DRAWING FILE NAME: A87508689.DWG	BENTHOS 49 Edgerton Drive North Falmouth, MA. 02556 U.S.A. TITLE: OUTLINE, AT–408 INTERROGATOR DRAWING NUMBER: A875–08689 REVISION DATE: 2/20/98 SCALE: NTS SHEET 1 OF 1



WEIGHT IN AIR: 26 LBS.
IN WATER: 12 LBS.

	REV	ECO NO	DESCRIPTION	DR	CHK	APPR
01/06/01	A	8281	UP-DATED TO BENTHOS FORMAT	GC		
DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR

TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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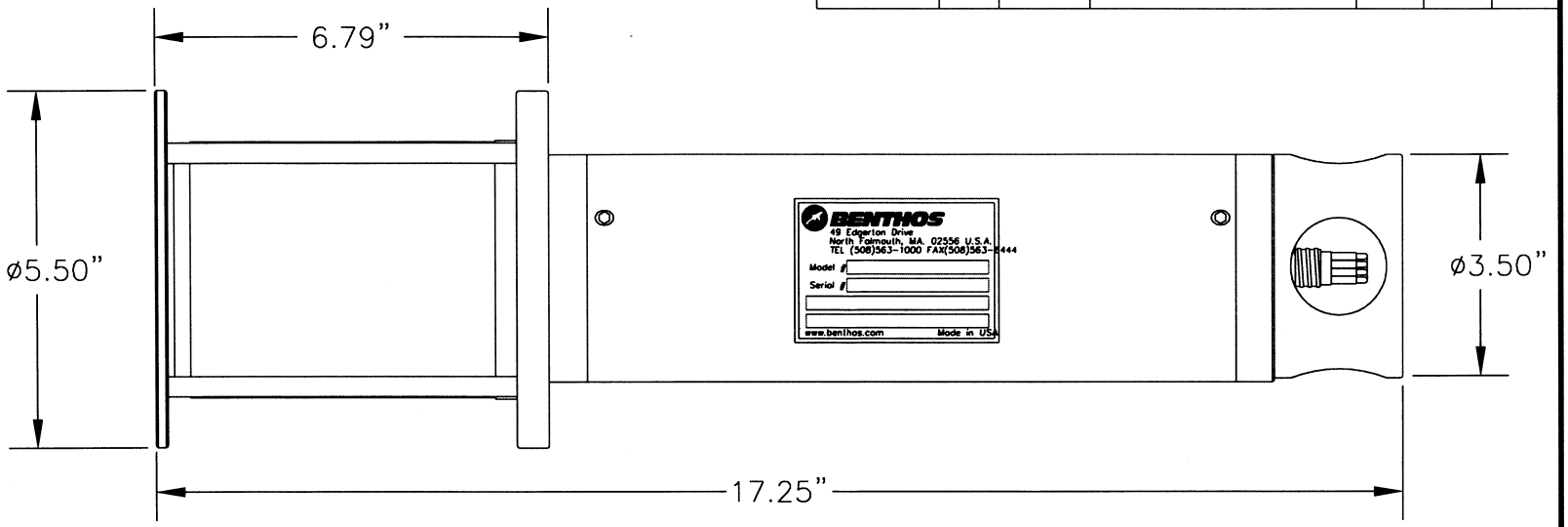
DRAWN BY: DMP
CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: B42108716.DWG

BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.

TITLE:
OUTLINE, AT-421
TRANSDUCER

DRAWING NUMBER: B421-08716
REVISION:
DATE: 2/4/98
SCALE: NTS
SHEET 1 OF 1

DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR
01/06/01	–	8281	UP-DATED TO BENTHOS FORMAT	GC		



TOLERANCES EXCEPT AS NOTED DECIMAL .X=±.015 .XX=±.010 .XXX ±.005 FRACTIONAL ±1/64 Hole size &location ±1/32 General ANGULAR ±1° BREAK SHARP EDGES EXCEPT AS NOTED R.010 63 ALL surfaces except as noted	CONFIDENTIAL This document and the information contained therein is proprietary and confidential to Benthos, Inc. and may not be used, reproduced, or disclosed without the express written consent of Benthos. DRAWN BY: DMP CHECKED BY: APPROVED BY: DRAWING FILE NAME: A87509248.DWG	BENTHOS 49 Edgerton Drive North Falmouth, MA. 02556 U.S.A. TITLE: OUTLINE, AT–421MF INTERROGATOR DRAWING NUMBER: A875–09248 REVISION DATE: 2/20/98 SCALE: NTS SHEET 1 OF 1

10 Modem Components and Accessories

This section includes lists of the available ATM-880 and ATM-890 Series Acoustic Telemetry Modem components, along with cables and OEM kits.

Table 10-1 Acoustic Telemetry Modems—Surface

MODEL NUMBER	DESCRIPTION	PART NUMBER
ATM-891	Deck Box, No Filter	010158
ATM-891-LF	Deck Box, LF	010926
ATM-891-MF	Deck Box, MF	010927
ATM-891-HF	Deck Box, HF	010928
ATM-880	NEMA Housing	009563

Table 10-2 Acoustic Telemetry Modems—Subsea (2000 m)

MODEL NUMBER	DESCRIPTION	PART NUMBER
ATM-885/LF-O	Modem, LF, omni	009262
ATM-885/MF-O	Modem, MF, omni	009264
ATM-885/HF-O	Modem, HF, omni	009261
ATM-885/MF-D	Modem, MF, directional	009263
ATM-885R/LF	Modem, remote transducer, LF	009265
ATM-885R/MF	Modem, remote transducer, MF	010225
ATM-885R/HF	Modem, remote transducer, HF	010226

Table 10-3 Acoustic Telemetry Modems—Subsea (6000 m)

MODEL NUMBER	DESCRIPTION	PART NUMBER
ATM-887/LF-O	Deep modem, LF, omni	—
ATM-887/MF-O	Deep modem, MF, omni	—
ATM-887/MF-D	Deep modem, MF, directional	—
ATM-887R-LF	Deep modem, remote transducer, LF	010665
ATM-887R-MF	Deep modem, remote transducer, MF	009562
ATM-887R-HF	Deep modem, remote transducer, HF	010666

Table 10-4 Remote Transducers

MODEL NUMBER	DESCRIPTION	PART NUMBER
AT-408/LF	Omnidirectional transducer, LF (2000 m)	007744
AT-408/MF	Omnidirectional transducer, MF (2000 m)	008008
AT-408-HF	Omnidirectional transducer, HF (2000 m)	008010
AT-421/LF	Directional transducer, LF (6000 m)	007715
AT-421/MF	Directional transducer, MF (2000 m)	008501
AT-421/MF Deep	Deep directional transducer, MF (6000 m)	008432

Table 10-5 OEM Kits

MODEL NUMBER	DESCRIPTION	PART NUMBER
ATM-885PCB/LF-O	ATM-885PCB modem board set, LF, omni	009552
ATM-885PCB/MF-O	ATM-885PCB modem board set, MF, omni	009554
ATM-885PCB/HF-O	ATM-885PCB modem board set, HF, omni	009551
ATM-885PCB/MF-D	ATM-885PCB modem board set, MF, dir	009553
ATM-885RPCB/LF	ATM-885RPCB modem board set, LF	009266
ATM-885RPCB/MF	ATM-885RPCB modem board set, MF	009665
ATM-885RPCB/HF	ATM-885RPCB modem board set, HF	009666

Table 10-6 Cables

DESCRIPTION	PART NUMBER
0.5-m serial/power cable for use with subsea modems	C-270-11
25-m transducer (deck) cable for use with ATM-891	010190
50-m transducer (deck) cable for use with ATM-891	010191
75-m transducer (deck) cable for use with ATM-891	010192
2-m transducer cable for use with ATM-885R and ATM-887R	007810
10-m transducer cable for use with ATM-885R and ATM-887R	008363
25-m transducer cable for use with ATM-885R and ATM-887R	008364
RD Instruments ADCP interface cable	B-270-71